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Blake's Improved Compound Duplex Pumping Engine.

When the thriving town or village arrives at thaf stage of growth and prosperity that its inhabitants commence to agitate the subject of the more important local improvements, the first subject that generally occupies their attention is the question of the adoption of water-works and sewage systems. It reflects great credit on the intelligence of our people to note the already large list of villages, towns and small cities that are enjoying the sanatory and other benefits of a good water supply and sewage system, for they both of necessity go hand in hand. As most places are not favored with a natural head of water in the immediate vicinity from which an adequate supply can be drawn by gravity, they are of course dependent upon a *pumping* system.

In the case of many small towns, the effort to raise the funds necessary to build a complete water-works is often attended with much exertion and trouble, and the cost of the pumping machinery is of no little importance in the sum total of outlay.

Very few towns can afford the expensive rotative, or "Cornish," pumping engines in common use by large cities, as the first cost is too great.

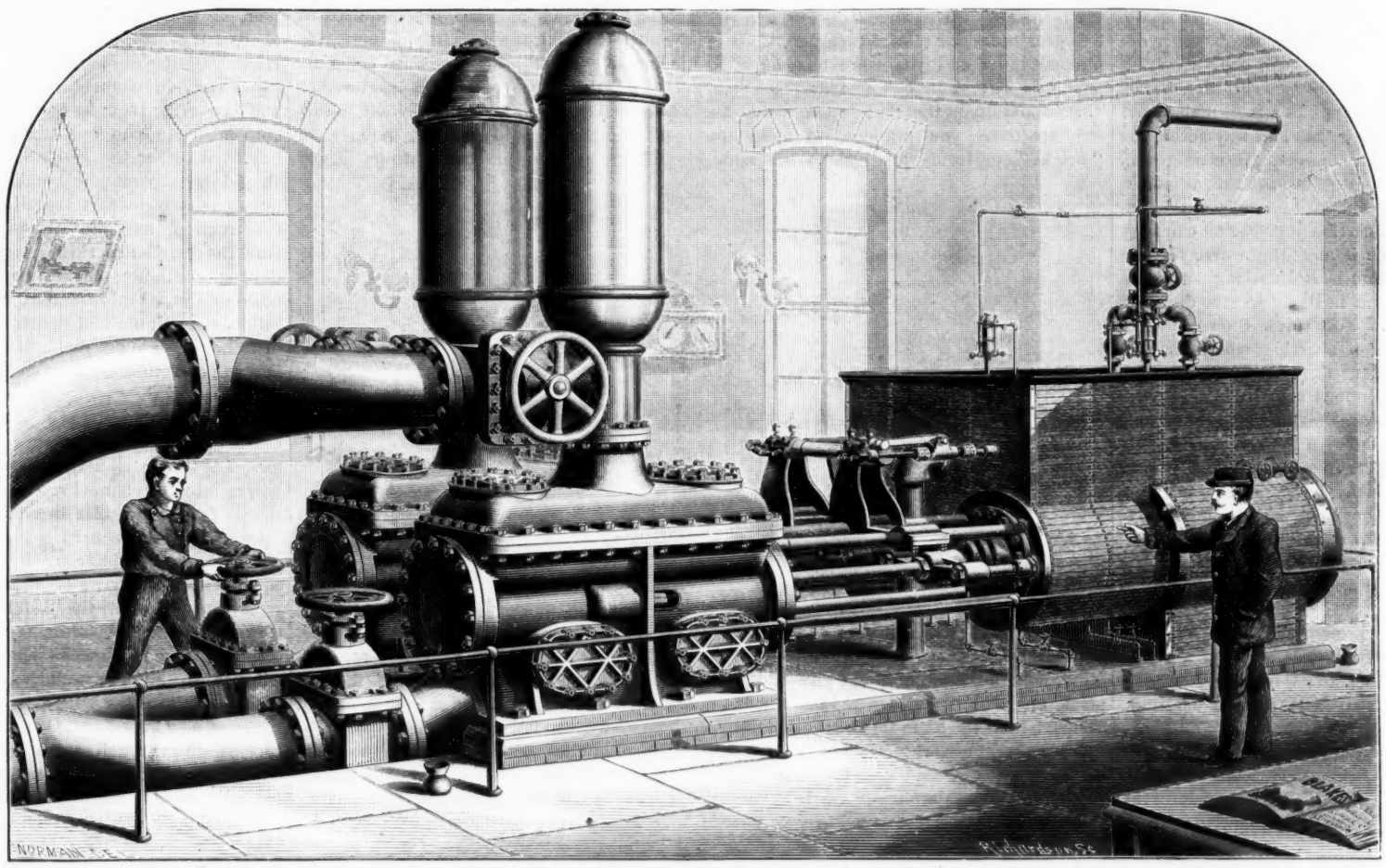
To secure a simple, inexpensive, and withal an economical water-works pumping engine is the great desideratum, and to fill this want the direct-acting pumping engine seems well fitted.

The improved direct-acting Compound Duplex Pumping Engine, built by the George F. Blake Man'f'g Company of New York and Boston, with its simple condensing apparatus, it is claimed, will follow so close in its record of economy in the use of fuel, that it can be favorably compared in its average or yearly duty with the more expensive rotative and "Cornish" engines. Its other advantages, besides reduced cost, can be enumerated as follows: No massive foundations are necessary; the engine house is considerably smaller; the amount of labor in its erection is considerably less; the number of working parts being so few in number very little expense is required to keep the engine in the best running order. In short, the economical advantages resulting from the expansion and condensation of steam, are very effectively obtained without the complication of parts, such as cranks, fly-wheels, working-beams, journals, &c., which are always liable to derangement, and subject to lost motion and excessive friction.

The pumping engine here illustrated is now in operation in the high service station at Washington, D. C., and supplies water to the stand-pipe on Meridian Hill. The capacity is five million gallons in twenty-four hours. The design of the engine, as a glance at the engraving will show, is compact and symmetrical, and shows a well finished exterior. The high-pressure cylinders are immediately in front of the low-pressure cylinders, forming a direct and close passage for the steam to expand from the former into the latter.

In each set of cylinders, the piston of the high pressure cylinder has one piston-rod, while the piston of the low pressure cylinder has two. These rods, together with the piston-rod of the water cylinder, are strongly attached to the cross-head, from which the valve gear takes its motion by means of the rocking lever. The steam valves are of a simple but very ingenious character; there is no *dead center*, and the working of the pumps, when in full operation, is without shock or vibration. It will be noticed that no air pumps are shown connected to the engines; this feature, or rather the absence of the usual arrangement of connected pumps, is certainly an advantage, as by the use of an independent condensing apparatus, the main engines are relieved of a certain amount of drag, which means a saving of fuel.

Unlike any other direct-acting duplex pumping engine, it can be operated *singly* as well as *conjointly;* that is, in case of accident or during repairs, one set of cylinders can be operated with the same *positive* and effective motion as if the engine was running duplex. This feature is certainly one calculated to attract the attention of engineers and water-works committees, as it does away with the necessity of having a pumping station supplied with an additional or auxiliary pumping engine. In other words, the outlay for a set of spare pumps, to be used in case of emergency, is entirely avoided.



BLAKE'S IMPROVED COMPOUND DUPLEX PUMPING ENGINE.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * Some machinists judge of a workman's skill by the general elegance and nice appearance of the work done. I never could look at machine work this way. Skill is an element of the process not of the result. Many a rough thing may be skillfully done, and many a fine thing unskillfully done. The workman in a watch factory may be perfect, but that is no more reason that he is more skillful than the perfect man in a reaper shop.

There are many kinds of nice work. You have that instant appearance of an intention well carried out, we call tip-top.

But look at another machine, with the screws and other parts of such a shape as to indicate at once that such was not the exact intention; with polished surfaces, having a soft, wavy, or washed appearance; forgings, so far from the proper thing as to show tool work on corrected parts; with castings with clearances filed in them; and with certain surfaces which seem to have changed their intention when half done; these things you say are unskillfully done.

There is no doubt about one of these things being skillfully done and the other not, but the very same workmen may have done them. The management was unskillful, at any rate, in one case.

A thing don't have to be elegant to be well done. The bad machine was undoubtedly intended to be well done without being nice. As such it was an abortion, and it will generally be found more difficult to do good work without refinement than to do it finely.

* * * * If you want good work you tell a skilled man, provided with proper facilities, to do his best, and he does it, and you get your work. But tell him to make it as good as can be made, but to pay no atten-

Screws, without regard to their proportion of size or adaptation to purposes, if they turn a sewing machine upside down and find many qualities of work all equally well done. A neatly shaped, well surfaced, untouched drop-forging, strikes your eye and stands criticism. Flat parts have a flat finish—a hard, high polish, and pure surface generally, and you pronounce them well done. Small parts generally have a certainty and decisiveness about their shape and surface, and meet your approval.

tion to niceness, and your skillful man is mixed. He fails entirely to comprehend the situation, and thinking you mean general cheapness of work he slouches every thing, and probably loses his old skill in course of time.

* * * * Some of the work done on mowing machines to-day is as good as was ever done on locomotives, or machine tools. or sewing machines, or watches The men are as skillful, and the intentions are as well executed. The men could not change places. The skillful man does bad work when he puts his work in the wrong place, as he does when he puts it on one piece of a reaper when the same work should have been put on six pieces! Try to get good reaper work out of a rail-road machinist, or a machine tool man, or a sewing machine man. You soon find he don't know how. Try the reaper man on link work, or a lathe carriage, or a needle bar. You soon find he don't know how. The work in both cases will show unmistakable evidence of having been badly and unskillfully done. and still the men are known to be skillful. To put skilled labor at the right work is the duty of skilled management. Lead lapping a reaper journal would be an unskillful process. It is the fault of the manager not of the man. Finishing an engine crank-pin with a file, would be an unskillful process, the fault of the manager not of the man.

* * * * A lack of uniformity in one piece is what often gives a workman away. He planes a flat piece and half way across the job the character changes. It attracts and repels you, for you see at once that whatever the intention was about the surface, that intention was not carried out. You can't say that the surface is any the worse for the variety, but there is a lingering suspicion that the workman is liable to give down on most anything. You think the same when you see a piece of shafting which changes color three or four times in its length. A clean, pure continuous roughing cut always looks finer than a finishing cut that seems doubtful about how to look, and presents a variety of surfaces in a short stretch.

* * * * If a good, fine job don't look fine enough you can go ahead and make it look fine enough. You simply stopped too soon, but if you want a good job with the hyfalutin left off, and you find it begins to look "ratty," you can only remedy the matter by going back on the original intention and doing it finely.

* * * * One of the most difficult things known is to get a tip-top job done with the finish omitted.

There are certain engine builders who build two kinds of engines, what they call "bright" and "black." "Both exactly the same as far as real merit is concerned," you know. "Only a difference in looks and price." The bright kind has a miscellaneous lot of finish on the details, the shaft and wheel rim, and bed-top are planed and finished, a polished governor is ordered, nuts and bolt heads polished, brass work of the nicest kind, blued set screws, &c.

Now it's all fine enough to stuff a customer with the idea that one engine is as good as the other, but it is false all the same. You get an order for a bright engine. You cast the cylinder. There's a blow in the flange. Do you use it? No. Do you break it up? No. You put it in the casting shed. What for? Why to use on some engine not "bright," you know. Another is cast and bored and a scab or two develops. You put it in the casting shed with the other. It will come into play all right. Some lunk-head drills a cylinder head wrong. You lay it away. It can be plugged and used on another engine. The pillow block gets poured with "that good babbitt." A stuffing stud gets a thread or two torn out or it fits the nut too loose. "Make another, Harry, but save that one." Two or three cylinder studs are fitted too loose in the flange. Are they crowded in hard on the shoulder so as to pass muster? No. But they will be crowded into another engine in a month or so, but not a "bright" engine. The connecting rod brasses don't seem to work just right under a tool. Save them "Do you want iron set screws in here, sir?" "No, siree, young man. Put in good nicely fitted tempered steel screws." The nuts on hand won't do for this engine. They ain't good enough. Tom is told to spread himself on the piston packing. The fly wheel and eccentric keys are driven out to see if they were fitted well. The valve receives extra care. The crank-pin for a wonder is made round; and so are the main journals. Stub ends are made perfect. Hexnuts are hexagon and uniform. No lumps are allowed on the main shaft. The guides are straight and flat, and the crosshead is brought fair all round, no matter how much work it makes. The eccentric don't "cam" sideways, and the strap fits it when the job is done; and may be a cut will be taken over the bottom of the bed, and the question as to whether the old foundation washer pattern was just the thing, comes up; the finish on the connecting rod shows it to be good iron. If necessary the president's desk will be wrecked to get well seasoned walnut to jacket the cylinder with, the spade handle on the valve stem joint is the second one made for the job, spanners are made to *fit* stuffers, solid wrenches ditto, oil cups are selected with a view to lubrication, the cylinder oiler is studied on before selection, the cylinder cocks have drain pipes attached, and so on through everything.

Now, one question, Mr. Editor—When you took this order for a bright engine, it was a hurried order and you were busy on good paying work. You had a new "black" engine unsold upon the floor, made from the same patterns you proposed to make the "bright" one from—just exactly the same, you know, "except in looks and price." Now, why in the world didn't you take that black engine apart, put a red-hot finish on the parts, put the extra finish on extra parts, order a bright governor, deliver the engine, get your money, and call the transaction complete? Why didn't you do this simple thing? Simply because you knew very well that the black engine was not good enough to make a bright engine of.

* * * * The idea that by omitting useless finish, and keeping the essential parts the same, the work will be cheapened, has led more than one fine mechanic into years of trouble. One of these superior mechanics says to himself: "I intend building machinists' tools; I see that those in the market are excellent and highly finished. This finish costs money; I will leave it off and save that much cost, and by doing the real work in a perfect manner, I will, in course of years, win for myself a name as a manufacturer of tools of superior excellence at low prices; I will thus be doing real good." Our enthusiast will go at it, and his first fruits will look rough to himself and his customers, and he will be astounded at the cost. He improves the character of the essential workmanship and strives to reach perfection. The work gets better, but the cost increases largely. To cut down the cost, he fills the air with system, and brings into play the keenest of manufacturing wit. This will run on for years, and he will finally be compelled to say to himself, that it is impossible for him to compete with builders who do lots of unnecessary work on their product. There is no earthly hope of ever being able to get unfinished work as cheap as finished work. The cheaper design costs the most money. The amount of functional service, and the character of contacts, and the nature of material, is not a whit better, but still the cheapest machine costs the most money. The machine designer, who leaves that little thing called human nature out of the design, who thinks his own broad ideas will meet with a response in the minds of his workmen, makes a grand mistake. He must make a virtue of his demerit, and must invent arguments to prove that finish is a damage, that merit associates with paint only.

* * * * Very respectfully,

CHORDAL.

Telescopic Jack-Screws.

The accompanying engraving represents two descriptions of what are termed by the patentee "Telescopic Jack-screws." The term is appropriate to the construction, as one of the lifting screws is within the other and resembles somewhat a telescope in movement. One jack-screw, Fig. 1, is constructed so as to be operated by a forked lever, and the other, Fig. 2, by a ratchet lever. These jack-screws consist of two wrought-iron screws, one moving within the other and operating simultaneously. By this method of construction, the screws can be run out nearly double the height of the base, and will raise a load in one-half the time required by the ordinary jack-screw, without increasing the labor. These jack-screws are generally very highly approved of in engineering works. They are highly serviceable in rail-road, bridge and ship building, removal of buildings, and in all cases where heavy weights have to be moved. They are said to be the longest and also the shortest jack-screws now in use, and weigh less than any others of corresponding capacity.

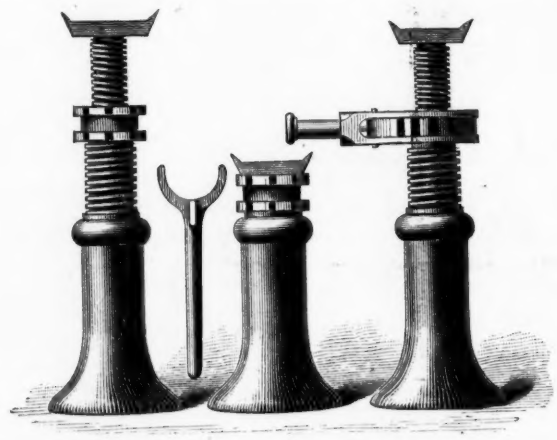


FIG. 1. FIG. 2.

The manufacturer constructs five sizes, from No. 1 to No. 5. No. 1 has stand, 10″; screw, 14″; net rise, 11″; whole length, 20″. No. 5 has a stand, 25″; screw, 40″; net rise, 36′; whole length, 61″.

Further information may be had from the manufacturer, Albert Bridges, 46 Cortlandt St., New York.

Type-Setting and Distributing Machinery —Facts and Opinions.

BY WILLIAM A. LORENZ.

As thought is essential in working both composing and justifying machines, they cannot be made automatic. The distributer, however, can be made automatic, and it therefore effects the greatest saving over hand work. The key-acting distributers of Rosenberg, Delcambre, Kastenbein and others, are too slow to effect the saving required. The automatic distributers of Alden, Beaumont, Houston, and Brown have all failed, because some principle was wrong, or some important feature lacking. Slingerland has shown remarkable ingenuity in improving the Alden machine, which is still being perfected in Brooklyn; and the builders promise good results. Thompson designed a distributer, which after a checkered history was combined with the Paige setter at Hartford; and Mr. Paige expects soon to show something practical. There are men at work to-day on type-setting machinery in New York, Rochester and elsewhere, and also in Europe.

By far the greatest amount of composition done is newspaper work; this class of work offers the best field for the introduction of machinery, because the work is regular, and the many adjustments of reservoirs, race-ways and galleys are unnecessary. These adjustments make a machine much more expensive and difficult to build. Therefore my advice is to design the machines to run on small type, Agate or Nonpariel, and to use but one size—for a newspaper will keep the machinery on one size constantly.

The plan of both machines should be as direct as possible; the fewer times the type is dropped and lifted, turned and pushed, the better—it saves a multiplicity of parts. Avoid the use of single removable reservoirs on the machines; the confusion that will certainly arise in an office where single reservoirs are used will condemn the rest of the machinery. In the setter accept as a law that a key-stroke *must invariably deliver its type to the receiving-channel, and as rapidly as the operator wishes to strike.* If the machine is limited in speed, make it up by setting many types at a stroke. Study the "freak" that all type are liable to, especially small ones, of getting crooked or raised *off their feet,* and avoid any plan that allows this.

Make the distributer automatic. If the plan of the machine is simple, nick only about 100 of the most important characters. Handle all the unnicked type, italics, small caps, etc., in channel reservoirs, inserting and extracting them by hand, and have them convenient to both operator and distributer boy. Whether the setter and distributer should be separate or combined, machines must be determined by the principle of their construction, and the system they follow. Run the distributer slowly, say, 175 revolutions per minute; make up lost time by building the machine double, when 350 revolutions per minute will distribute 80,000 ems in 10 hours. Do not make the machine nick in agate or nonpareil more that $\frac{1}{100}$th of an inch deep, or the type will be too weak and the blow-holes in the type will be exposed. Use a mixed-letter reservoir in the distributer. Let the distributer boy assort the mixed letters into the channel reservoirs. Arrange spaces for the justifier in channels, so that they are quickly secured. Do not allow the use of boxes of disarranged type, but make the machines take care of all nicked type in reservoirs. Design the machines so that they will be self-cleaning, especially in the selecting and feed-mechanisms of the distributer, so that dirty and sticky type, and type caked together will pass everywhere as freely as new type. Adopt as a rule, that all type passing through grooves shall be guided on all sides, and not left entirely free, even for an instant. Arrange the machinery so that it can be easily taken apart and assembled again, and so that oil cannot get into the type. Make wearing parts adjustable, and have no cords, rickety parts and parts soldered on. Thin reservoirs of tin and weak ones of wood should not be employed. The racket on key actions, and in fact the carelessness of machine hands, generally, will break down any poorly-made machinery.

Let the justifier work in connection with the setter, and do not justify from long sticks, in an ordinary hand-composing stick, under any circumstances.

When testing machinery it should always be tried in a printing office, with type in every-day use; failure to test with electrotyped, stereotyped, or washed type will lead the builder into many fatal errors. When testing, employ operator, justifier, and distributer boy, keep away from the machines, and let their faults show themselves.

By all means employ a machinist in charge of the machinery when running it practically in numbers. Draft rules and stick to a machine system throughout. Neglect in this matter may destroy much of the usefulness of good machinery. By adhering to these plans, the composition will be rapid and direct, and will be cheap, few type will be broken or battered, and the proofs will turn out well.

Experience for several years has shown on the Green machinery that operators stand the work of type-setting uninterruptedly 10

hours a day; that it pays to employ good compositors, or to break in smart boys of about eighteen years, and get out a large amount of work from each machine per day. Average operators learn to finger on these setters 30,000 ems per day, inside of three months. Good operators have averaged 56,000 ems per day, and I believe that in five hours time a good operator could strike off 40,000 ems on proper newspaper machinery.

For regular newspaper machinery an average speed of 6,000 ems per hour per machine is practical, but more is possible.

The cost of running the Green machinery on fairly regular work was divided thus:

Operator	6c.	per	1,000 ems.
Justifier	6c.	do	do
Correcter	3c.	do	do
Distributer boy	2c.	do	do
Helper	1c.	do	do
Machinist	1c.	do	do
Total	19c.	do	do

which is about 26 cents less than the price of newspaper work.

A pair of newspaper machines, well designed, strongly built, rapid in execution, that would last ten years, having appurtenances to handle all the characters in a newspaper using regular advertisements, could be built for $1200 in a properly organized shop. They would be cheap if sold for twice that, presuming them to save no more than fifty per cent. over hand labor.

Without wishing to force my opinions on men who are now engaged in constructing type-setting machinery, I can strongly advise them to consider these suggestions. My experience with type-setting machinery both in the experimental shop and in the printing office, has convinced me that the laws enumerated above are essential in building newspaper machines. The introduction of machinery employing nicked type will undoubtedly be difficult, but our leading dailies will not hesitate long when once a good machine-compositor can strike off six to eight thousand ems in an hour, at one-half the cost of hand work. It is the direct, rapid and well-made machine which will form the entering-wedge into the newspaper office, and when once there, the book-work machine, running many sizes of type, will follow.

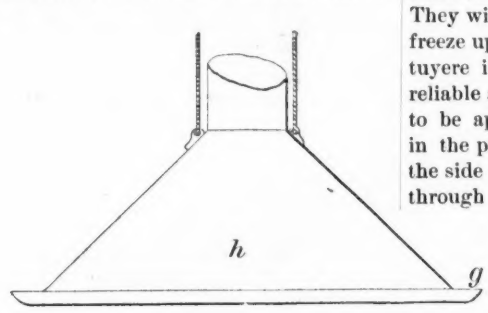
Practical Blacksmithing.—Bellows and Forges for General Work.

BY FREDERICK LEWIS.

In my first article on blacksmithing, I advocated the use of the old-fashioned leather bellows. The force of the blast may be regulated by placing more or less weight upon the top board, which drives the air with more or less force through the nozzle into the tuyere. Canvas should be tacked to the top board of a bellows, in the form of a curtain, all around, and allowed to cover the leather part of the bellows, to protect it from being cut by pieces of iron; also to prevent the life of the leather from being destroyed by the dust and gas. Great care is necessary in selecting a good bellows. The leather should be of the best quality. The leather in some bellows, after being in use for a short time, will stretch so as to greatly impair the blast.

The best way to hang a bellows is to make a frame from oak timber 2″x4″, by placing one piece across below the bellows, one above, and two upright pieces—one on each side. These pieces should be mortised together and braced. The bellows is held in this frame by the two pins attached to the middle board. The lever, though a simple contrivance, is very essential, and should be proportioned as 72″ is to 22″. The different sizes of bellows are designated by the width of the top board as 36″, 40″, etc. This style of bellows is generally worked by hand, or a treadle attached to the lever, and operated by the foot. I have known cases where they were operated by power, but when power can be had I prefer a good blower.

A section of a cast-iron forge is shown in Fig. 1, which is adapted to general machine blacksmithing, and is capable of heating iron up to 4″ in diameter. It is made of four pieces *a*, about five feet long, which form the sides. These are held together by two rods, which pass through the two opposite sides, and having a nut upon each end, the front plate is removed to show the tuyere. The top, or fire bed *b*, is made in the shape of a hopper, as shown. The top of the tuyere iron is about 8″ below the top of the forge, so as to allow a good thick fire. The top of this forge should be about 20″ from the ground. To get the best results the top of the tuyere is made spherical, with a round hole at *e* in the center, which is 1″ to 1½″ in diameter. The cavity *c*, not only catches all the dirt which falls through the hole *e*, but also acts as a reservoir, thereby giving much better results than if the air were delivered directly into the fire. The pipe *d* communicates with the main air pipe, and the blast is controlled by the valve *f*.



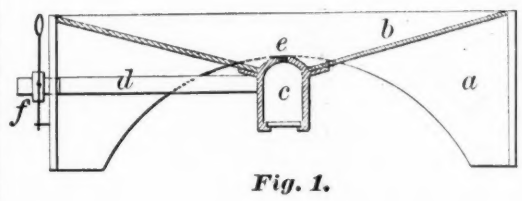


Fig. 1.

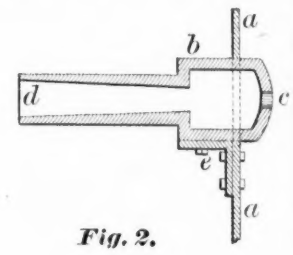


Fig. 2.

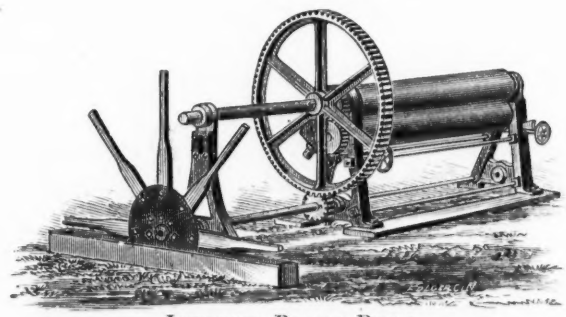
A fire can be built upon this forge in most every conceivable way. Either long or narrow, large or small. The coal and ashes upon the forge should be level with the top, and not be allowed to incline towards the fire, as many suppose, for obvious reasons. The hood *h*, differs somewhat from the one shown in the previous paper, as the pipe in this case is placed in the center. It is, therefore, necessary to use two weights to counter-balance it, instead of one used in the previous case. The edge of the hood is turned up all around as shown at *g*, to catch the dirt. A hood is of no use unless it will collect the smoke and gas and conduct the same to the chimney. I dropped in to a shop the other day where some of the finest work is done that can be produced in this country, and must say in regard to the blacksmith's shop that "it was the worst I ever saw." The forges were made of bricks and were in a dilapidated condition, while the chimneys (which were also made of bricks) looked as if they were ready to fall at any moment. The anvils and tools looked as if they might have been imported in the "Mayflower."

It is true, good work may be done under difficulties, but I advocate the plan of giving men a good comfortable shop to work in and plenty of good tools, and by comparing notes at the end of the year the latter plan will be found the most economical. For some work the side blast is preferable, as it admits of the fire being placed anywhere upon the forge. In some cases a simple nozzle is introduced in the side of the forge, while in others very elaborate inventions have been applied, such as the water tuyere, the water back, &c. The water tuyere is made of two cones or tapered iron tubes, placed one within the other, and the ends closed. By the application of two pipes to the large end, water is supplied from a tank which continues to circulate, thus keeping the tuyere cool. The objections to this arrangement are that while the water cools the tuyere, it also cools the air which passes through it, which produces a damaging effect upon the fire and the iron or steel placed therein.

The water back tuyere is a simple affair, which consists of an iron box with the nozzle, and tuyere formed in the side and near the bottom of the box. This plan presents the same difficulties as those found in the former. They will both eventually become leaky and freeze up in winter. An old fashioned square tuyere is shown in Fig. 2, which is always reliable and never out of order. It is intended to be applied to a forge like the one shown in the previous paper. Here *a a*, represents the side of the forge, which has a square hole through it to admit the cast iron tuyere *b*. The nozzle is shown at *c*, while *d* is to be connected to the main blast pipe. These tuyeres usually waste away by long use on the upper side of the nozzle, in which emergency the tuyere can be turned upside down by simply removing two bolts at the bottom. These bolts pass through the angle plate *e*, and hold the tuyere firmly in its place.

By using this kind of tuyere the fire should be built up of wet coal, leaving a space for the fire at the end of the forge opposite the tuyere, and when it has burned up near the tuyere, it should be re-made, and never allowed to burn up so that the fire will come in contact with the tuyere.

The blast is found to work better when the air has to pass through the coal before entering the fire, besides the fire can be kept clean and will do satisfactory work. Many different designs of forges and tuyeres have been invented and used to a large extent, but, I believe that the designs illustrated in these articles will answer every purpose where a forge is required for any kind of work which comes within the range of general machinist blacksmithing.



IMPROVED BOILER ROLLS.

New Boiler Maker's Tools.

For some unaccountable reason establishments engaged in the manufacture of iron workers' machinery, have failed to appreciate the real requirements of boiler makers. Simplicity, strength, and general efficiency must, of course, be involved in good machinery for any purpose but the boiler shop is one of those places where refinements of design and workmanship are not only wasted but cannot be afforded.

Very near every country machine shop a boiler shop is attached, and in the outfitting of this boiler shop more difficulty is experienced than in any other department. Almost all machine tool builders can supply boiler rolls but they are so refined and far-reaching in their design and construction that the price asked often exceeds the entire capital set aside for this small boiler shop. Such boiler rolls will often be found with as nice and accurate, and costly machine work upon them as the finest lathes and planers, something far beyond what is wanted or needed. Such rolls may be a good investment for a large and complete establishment, but for the ordinary shops they are completely out of the question.

These facts lead almost all shops into the construction of their own rolls, and as a result we often find that there is some grave miscalculation in their design. Rolls are found too weak, and they either break outright or spring so much as to roll bellying sheets. Capstan levers are put directly on one roll, and often on the wrong one, and the power is so inadequate that it becomes necessary to use five or six men to bend a sheet. As the parts are made six men can often break them. The rolls are often wrongly arranged so that the sheet will not be drawn in, and if a sheet is bent into a circle the whole machine must be dismantled to get the ring off. Altogether these home made machines are found to be grand failures, and at the same time the quality of the workmanship is fully as good as could be useful.

We illustrate, herewith, a set of the boiler rolls built by Messrs. Black & Clawson, of Hamilton, Ohio. They have been constructed with a full knowledge of what the average boiler shop needs and can afford to buy. All good qualities attainable at a low price are secured, and no fine workmanship is wasted on them. They are built of two sizes, the smaller having feed rolls, seven inches, and a bending roll, six inches, in diameter. The larger machine has feeding rolls, nine inches, and a bending roll, eight inches, in diameter. The lengths are, of course, various.

The rolls are all cast iron, heavy wrought shafts being fitted in the feeding rolls, and heavy wrought journals are shrunk in the bending roll. The bending roll adjusts by screws at such an angle as to move quickly from "straight" to "hug." Wedges operated by screws adjust the lower roll to pinch the sheet.

The upper roll has three bearings, the tail bearing being far out from the housing. The head bearing is hinged, and when it is turned down the upper roll is supported by two bearings, and its head end is open, allowing rings to be freely removed. A large spur wheel on the top roll shaft gears in a pinion on a bottom shaft. On the bottom shaft is placed a capstan wheel, which gives ample power and convenient position. When the machines are to be driven by power, a spur gear on the bottom shaft is driven by a pinion on a third shaft, which has a tight and loose pulley for a belt. The cut shows the machine as adapted for hand power only. The belt-driving portions may be added to a hand machine at any time.

A co-operative stove works will be started at Salem, Ohio, at once. The patterns are being made in Cleveland, and as soon as received work will begin.

A Boston man has invented a process of making paper boxes directly from the pulp. It is said that by the use of one set of his machines thirty thousand boxes can be produced in a day, at less than one-third of the lowest market price of hand made goods.

A quantity of red-hot iron fell into a tub of water in a rolling mill at Buffalo, recently, exploded and probably fatally hurt a workman.

The Supreme Court of Pennsylvania has decided that the change of a figure on a note, as to mark an 8 over a 7 in a date, impairs the validity of it. Either a new note, printed for 188–, must be used, or the whole date written before the printed figures on the old blanks.

Letters from Practical Men.

HOW TO MAKE A FIRE POT.

Editor American Machinist:

I hope some of your readers are anxious to know when that fire pot is coming along. You will find it enclosed. Right here I want to say, that, in my experience, I have found it a very handy thing in a machine shop, because there are innumerable little things that can be fixed with solder, and will be (as Chordal says) good enough. You will see from the illustrations how to build one, or have one built. This is for charcoal, and is the most economical, the easiest regulated, and gives the best satisfaction of that family of pots.

Fig. 1 is a side elevation, and Fig. 2 a longitudinal section; Fig. 5 is the plane. The material used is of No. 18 or 20 gauge black sheet iron. The body is round, and before being formed to that shape, it should be cut out, and all the holes cut into it in their proper places. To do this, you take your stock and cut out a square piece, the length of which should be the circumference of the grate, with one inch added for laps. The grate may be any where from 6 to 10 inches in diameter. You will probably find one that will answer your purpose in almost any tin shop. The width may be about 12 inches. Then lay out the holes as shown in Fig. 3, one at *g*, for the soldering irons to go through; another at *F*, for the smoke to go through; another at *f*, to pull the ashes through; then form it up, round and rivet it together, and rivet on the inside three lugs, as shown at *l*, Fig. 2. After this is done, turn an edge about $\frac{1}{2}$" wide, out all around the botton and top, just the same as on the bottom of a steam dome on a boiler. Then set the body on the piece of iron you intend to use for the bottom, and mark all around the outside of this edge. Then find the center of this circle, and strike a circle outside of that again, that will be $\frac{3}{8}$" larger, for an edge to turn over; cut this out on the outside circle—this is the bottom. Turn up this edge about $\frac{3}{16}$ all around the bottom, until it is about square. Before putting on the bottom it will be well to rivet on the body, the back pipe and the door slides. Then put the bottom on the body, and with a pein hammer pein down this edge all around on the body. The back pipe *B*, is best made square, as shown in Fig. 5. The hearth *C*, should be cut as in Fig. 6, and bent on the dotted lines, the sides *a*, being up, *b* are bent out and used as a flange by which to rivet it to the body. The notches *i*, are bent down, and a rivet put through each. The legs may be made out of $\frac{1}{8}$" × 1" iron, or larger, if you please, and bent to suit the taste, riveted to the bottom, as shown in Fig. 2. Sliding-doors should be fired to the body to close the two front holes when the furnace is not in use. These doors can be made to run in slides, as shown in Fig. 7, with the slides riveted to the body, as shown in Fig. 1. The top should be piened on the same as the bottom, but cut a round hole about 5" in diameter, and over this put a cover about 6" diameter with two lugs opposite each other, as shown in Fig. 5—one to be used as a handle, and the other as a hinge on which it swings. When the furnace is put up, fix a damper in the pipe, the same as in a stove pipe, and put under it a piece of iron to keep the heat off from the bench. If this is constructed, as per directions, you can light a fire in the morning, regulate it the same as a parlor stove, go to it any time in the day, and get a good soldering heat in three minutes.

Cohoes, N. Y. Geo. Guntz.

SIZE OF STEAM PORTS.

Editor American Machinist:

In your paper of Nov. 8th I noticed a very interesting and instructive article on valves, by F. G. Woodward, in which he advocates the many-port system. I want to ask him and Mr. Hoffman, if ports only $\frac{1}{8}$ of an inch wide, and in length and number equal in square inches to that, which a single port should be for the same engine, say a 10×18 inch cylinder (which is a "small" engine) would not wire-draw the steam and show an admission-line much below what the single port would; and also if ports $\frac{1}{4}$ inch wide, as per Mr. Woodward's letter, on a large engine say 48 × 60 inches, although aggregating in square inches the same as a single port would not also give same defect in a card? Having had a little experience in numerous and narrow ports however–not so finely drawn as Mr. Woodward's–and finding that the same area in numerous ports is by no means the same thing as that area in one, I should like to hear something further as to the actual area when so sub-divided necessary to give a full admission-line, as compared with a single port of sufficient dimensions. Presuming that friend Hoffman is "up" in such matters, will he shed a little light for the benighted?

Yours &c. F. C. Smith.

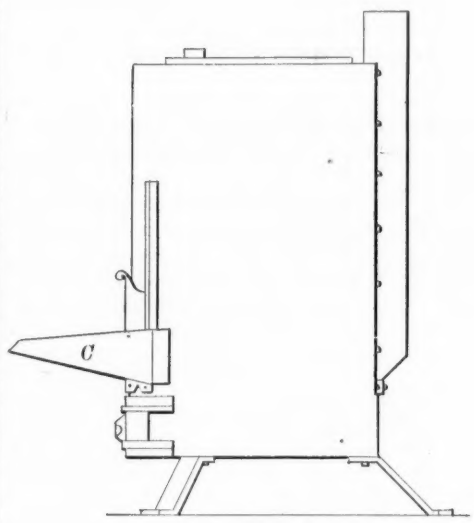


Fig. 1.

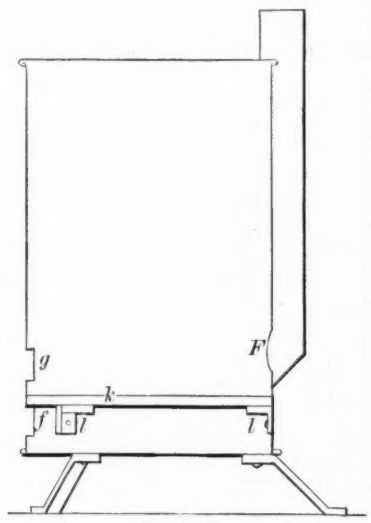


Fig. 2.

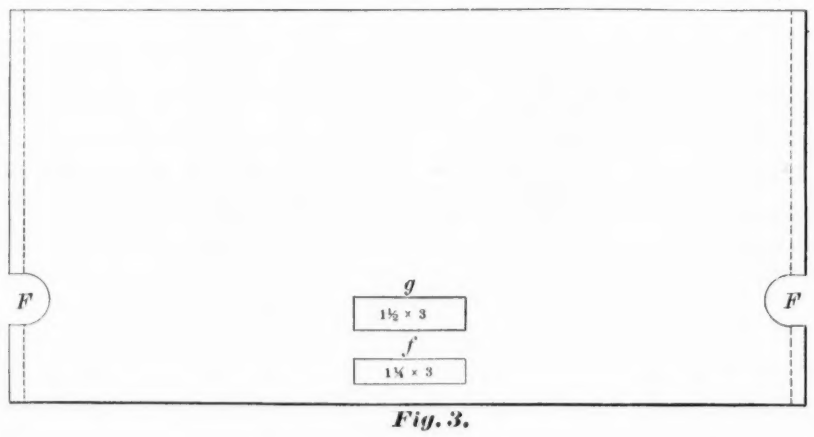


Fig. 3.

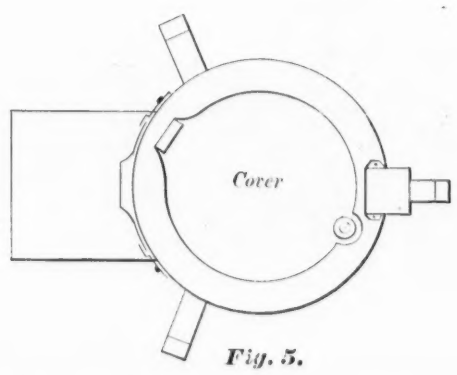


Fig. 5.

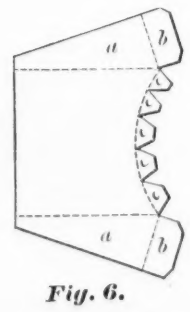


Fig. 6.

INERTIA, ENERGY AND WORK.

Editor American Machinist:

In No. 5, current Vol, I notice a few remarks by Mr. Odell in regard to "Lost Power." The conclusion at which he arrives, is that the energy stored up in balance wheel is $7\frac{84}{100}$ times the energy exerted by the piston.

Now, I wish to ask a question, and then give vent to some reflections:

Is the line of resistance *C D*, the indications of a dynamometer reduced to terms of piston pressure? It can not be the line of average pressure, for he states that there is $5\frac{1}{10}$ pounds pressure in excess of the resistance.

The recognized laws of inertia dictate to the effect, that matter endeavors to retain any certain condition until operated on by some influence tending to change its condition; therefore, a balance-wheel at rest, is in a condition of inertia of rest equivalent to its mass, and a certain value of energy must be expended upon it to revolve it 50 times per minute, plus sufficient energy to do the work of overcoming the friction of bearings, and also friction of the air; after the wheel is up to speed it is possessed of inertia of motion due to its mass, and 50 revolutions per minute, and to keep it up to speed it is only necessary to draw on the motor for a certain value of energy per minute, which (energy) is converted into the work represented by the friction of bearings and atmosphere; the inertia acquired by the wheel is entirely independent of everything, and if all friction were removed the wheel would revolve at the same rate forever, unless it was favored with an opportunity for converting the energy stored up by its inertia, into work.

The reason that an engine starts slowly and gradually (no matter how rapidly) comes up to speed, even with full boiler pressure turned on, is, that the moving masses of metal must first be furnished with energy equivalent to their mass and rate of motion; and this point having been reached, and the friction, of course, compensated for, the machinery is ready for business; a diagram taken under these conditions would be the "friction card" we sometimes hear of.

The consideration of inertia is then the controlling influence in the question of balance-wheel: if the wheel is too light it answers to every charge of the initial steam, and feels every drag of the latter portion of the stroke; but when sufficiently heavy it will absorb the surplus impulse of first part of stroke, without accelerating its speed, and give it out again when required, without falling below speed; the only objection to an extra heavy wheel being unnecessary cost, and an addition to the item of friction, the extent to which energy may be added to and taken from a wheel, is comparatively limited, and therefore it behooves us to proportion the wheel to the power and speed of the motor.

In regard to accelerating and retarding the

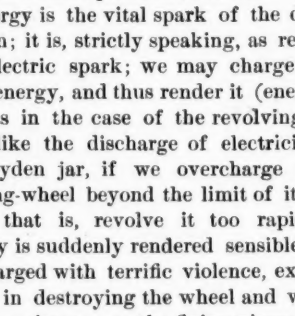


Fig. 7.

reciprocating parts, the steam pressure must, of course, accelerate them, but the energy they thus acquire is certainly expended to an extent just less the friction, against the crank-pin during the latter portion of the stroke, until interfered with by compression, and, judging from weights as generally found in practice, I should say that in the diagram presented by Mr. O., the retardation is completely used up in producing the high compression curves his diagram exhibits; the only "lost power" then would be that due to friction, even if the compression is partly formed by energy from balance-wheel. My impressions have always been that the "indicated power" was in excess of that accounted for; Mr. Corliss claiming for his Pawtucket pumping engine that 92 per cent. of the indicated power was utilized.

In stating my ideas of inertia, energy, and work, if I tread on the conventional corns of any Ph. D., I hope he will just "speak out in meetin'."

Inertia is that property of matter which represents its neutrality, and renders it susceptible to the operation of forces.

Energy is the vital spark of the dynamic system; it is, strictly speaking, as restless as the electric spark; we may charge a body with energy, and thus render it (energy) latent, as in the case of the revolving wheel; but, like the discharge of electricity from a Leyden jar, if we overcharge the revolving-wheel beyond the limit of its endurance, that is, revolve it too rapidly, the energy is suddenly rendered sensible, and is discharged with terrific violence, expanding itself in destroying the wheel and whatever offers resistance to the flying pieces. If we place energy under proper conditions it is converted into its equivalent of useful work or effect; in fact, energy once brought into existence is in a constant state of activity, until transformed into work in some shape or other, in which operation it passes out of existence.

Work or effect, is the conclusion or result of the operation of energy on matter.

In the operation of a steam engine driving the machinery of a factory, the energy developed from force moving through space, is converted into inertia of the machinery, and in such state is stored up without producing work, until steam is shut off, when this portion of energy is expended in overcoming friction until the motor and machinery is brought to rest; also it (energy) is expended in friction of the machinery, which is work; and again it is expended in producing the useful effect for which the factory is used, which is also work; and sometimes when the machinery gets out of "leading strings" energy, with admirable impartiality, proceeds to accomplish the work of tearing things generally. Respectfully yours,

Chas. A. Hague.

Chicago, Feb. 26th, 1880.

DIAMETERS AND NUMBER OF TEETH FOR GEAR WHEELS.

Editor American Machinist:

I think the following rules will be of value to some men. Diameters and number of teeth for wheels and pinions.

Rule 1.—As the number of teeth in the wheel+2.25 is to the diameter of the wheel, so is the number of teeth in the pinions+15, to the diameter of the pinion. Example The number of teeth in the wheel=210; the

diameter of the wheel=25″, and number of teeth in the pinion=30; to find the diameter of the pinion: As 210+2.25 is to 25, so is 30+1.5 to 3.7102 the diameter of the pinion.

RULE 2.—To find distance of centers between two gears (or gear and pinion). Rule: As the number of teeth in the wheel+2.25 is to the diameter of the wheel, so is half the number of teeth in pinion+half the number of teeth in wheel, to the distance of their centers. Example: The number of teeth in the wheel=210; the diameter of the wheel=25″; and the number of teeth in the pinion=30; to find the distance at which their centers should be placed. As 210+2.25. is to 25 so is $\frac{30\times210}{2}$-to 14.1342 inches the distance of their centers.

I also give some rules as to velocities. When wheels are applied to communicate motion from one part of a machine to another, their teeth act alternately on each other; consequently, if one wheel contains 60 teeth and another 20, the one containing 20 teeth will make three revolutions, while the other makes but one. From this the rule is derived, namely: Multiply the velocity of the driver by the number of teeth it contains, and divide by the velocity of the driven; the quotient will be the number of teeth it ought to contain. Or, multiply the velocity of the driver by its diameter and divide by the velocity of the driven; the quotient will be the diameter of the driven.

If the velocities of driver and driven are given with the distance of their centers: The sum of the velocities is to the velocity of the driver multiplied by the velocity of the driven as the distance of centers is to the radius of driver multiplied by the radius of driven.

EXAMPLE 1. If a wheel that contains 75 teeth makes 16 revolutions per minute, required the number of teeth in another to work in it, and make 24 revolutions in the same time.

Here $\frac{75\times16}{24}$=50 teeth; the answer.

EXAMPLE 2. If a wheel 64 inches diameter, and making 42 revolutions per minute, is to give motion to a shaft at the rate of 77 revolutions in the same time; required the diameter of a wheel suitable for that purpose.

Here $\frac{64\times42}{77}$=34.9 inches; the answer.

EXAMPLE 3. Required the number of revolutions per minute made by a wheel 20 inches diameter, when driven by another of 4 feet diameter, and making 46 revolutions per minute.

Here $\frac{48\times46}{20}$=110.4 revolutions.

EXAMPLE 4. A shaft, at the rate of 22 revolutions per minute is to give motion by a pair of wheels to another shaft at the rate of 15½; the distance of the shafts from center to center is 45½ inches; the diameters of the wheels at the pitch lines are required.

Here 22+15.5 is to 22 as 45.5 is to diameters required. $\frac{22\times45.5}{22+15.5}$=26.69, number of inches radius of the driven wheel, which doubled gives 53.38 inches the first diameter required, and 45.5 inches—26.69 inches=18.81 inches, is the radius of the driver, which doubled gives 37.62 inches the second diameter required.

T. W. R. MCCABE.

Philadelphia, March 1, 1880.

BRACING CROWN SHEETS OF BOILERS.

Editor American Machinist:

Dear Sir:—Our friend Mr. W. H. Thompson of Cleveland, Ohio, brings your humble servant (and all others who have suggested any improved methods of holding up crown sheets) up with a "round turn." I did not intend to be guilty of advocating anything "terrible" or dangerous in boiler construction, and will here explain my position as regards locomotive boilers. In the first place, I do not believe in *crown bars*, for the reason that they *displace* too much *water* where the *greatest* amount of water is absolutly needed. The result of this water displacement is the shortening of the life of crown sheet, and a falling off of evaporative power. I think these points will be conceded by all practical as well as theoretical engineers.

I have seen *many* boilers where there was so little space between the under side of crown bars and top of crown sheet that the signs of burning were noticeable at a glance.

My idea of staying a crown sheet is to connect it to the proposed T iron rafters, riveted to shell by thin and wide steel stay rods. Sockets and spring collars can be used in connection with these if deemed desirable, but I do not consider the latter attachments necessary. Now the side fire sheets of a locomotive boiler probably lengthen a little less than $\frac{2}{10}$ of an inch as an average, never more than ¼ of an inch, while the outside side sheets up to the crown sheet, lengthen about $\frac{1}{12}$ of an inch, *but* the continuous outside sheets of shell including the side sheets just mentioned will lengthen nearly $\frac{4}{10}$ of an inch, and in so doing will raise the outer shell crown $\frac{2}{10}$ of an inch, thereby equalizing the distance between the flat crown sheet and the crown of the shell at the *center*, where the longest stay rods are placed, or in other words the outside shell is raised by its own expansion about the same distance as that due to the expansion of the side *fire* sheets. The upright stay rods at the sides will lengthen about $\frac{1}{30}$ of an inch, the next row $\frac{1}{30}$ and the center rows less than $\frac{1}{20}$ of an inch, and the *depression* on the crown sheet at the *center* will therefore be less than $\frac{1}{20}$ of an inch, caused of course by the expansion of the central upright stays. If these stays are thin and of steel, they will not resist the compressive strain due to expansion, but will buckle enough, without injury to them, to allow for this expansion, and the crown sheet will *not* be necessarily depressed at all.

I rather like Mr. Thompson's style of "pitching in," and sincerely hope to hear from him often in the MACHINIST on the subject of staying boilers; but I fear he will never convince me that the proper thing to do in that line is to fill the space over the crown sheet with *crown bars*, for to my mind that is simply jumping out of the frying pan into the fire.

I have only one complaint to make in case of Mr. Thompson's and Mr. Smith's articles on over-bracing viz.—they fail to credit the *total* expansion of the outside shell of boiler.

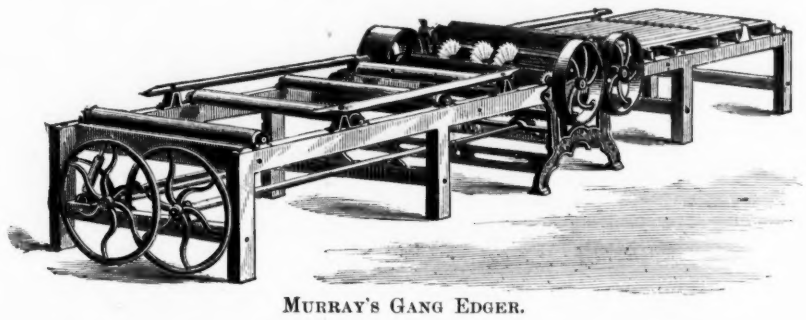
WM. H. HOFFMAN.

Passaic, N. J.

English makers continue to be exercised that the tramway companies show a preference for American-made horse-shoes, and investigation has satisfied some of them that the reason for this preference is to be found in the soft nature of the shoe, which permits of the shoe being bent cold upon the anvil by the farrier to suit any hoof. With a view to entering into competition with the American product, prominent makers hereabouts are still considering the advisability of securing American machinery.—*Iron.*

New Gang Edger and Improved Lumber Trimming Machine.

Of the two wood-working machines, shown in the accompanying illustrations, the Gang Edger serves an important purpose, namely that of securing accuracy and uniformity in the width of the strips, scantling, etc., upon which it operates. It prevents waste and depreciation in value of the lumber, an economy which in this age of improvement and competition is indispensable for large profits. This object is effected by latching the hand wheels that man the saws, so that when changing widths, the movable saws will be set with precision and held fast while the saws are cutting. One of the movable saws is moved with a handle, which has a spring attached to the side of it working in a quadrant, with hatches to receive the spring. This saw may be instantly changed to saw 4, 6, 8, 10 or 12 inch widths; more notches can be filed, if necessary. The hand wheels have notches on the rim at 4, 6, 8, 10 and 12 inches, with springs attached to the floor to fit into the notches. These spring latches cannot wear loose and allow the lumber to be inaccurate. The saws are all movable; when four or more saws are required, they are put stationary. The gauges are of iron, 8 feet long, 5 inches wide, the edges planed to guide all the lumber perfectly. When four saws are used, most edgers need the movable gauge on the side next to the stationary saw, which is usually on the pulley side of a machine, and a stationary gauge next to a movable saw on the other side. The saw arbor has three bearings in a heavy iron frame, with an iron stand to make the outer one solid. The bearings are furnished with anti-heating arbor box caps. Rubber packing is used for adjusting when screwing down the cap; cotton wicking is laid in the channels against the arbor to prevent the oil from flowing too fast, which stops it altogether when the arbor is at rest. The idle rolls are of iron, turned, four inches diameter and 48 inches long, and they are mounted on substantial wood frames, that hold the rollers perfectly parallel in order to carry the lumber through straight. The machine itself is all built of iron and steel and is independent of itself, the wood frame being bolted to ears on the side. It is substantially built, and should run nicely for many years. As now constructed, this machine is regarded as one of the best Gang Edgers in use; it is still growing in favor, as it becomes known to manufacturers, on account of its substantial make, quantity and quality of work and facility of operation.



MURRAY'S GANG EDGER.

MURRAY'S LUMBER TRIMMER.

The working capacity of this machine in green white pine is from 75,000 to 125,000 feet per day.

The practical working of the Lumber Trimmer, shown herewith, deserves careful notice. The saws slide four feet each on the arbors. By turning the crank one revolution each saw is moved 12 inches; one-half revolution moves each saw 6 inches. Both saws are moved by the one crank. The crank has a spring attached to the side of it that fits into notches, to hold the saws in their places when set to the exact length of cut desired. The lever on the left is to stop or start the transfer chains, which are driven by face frictions, and which can be changed to drive them fast or slow. Two sizes of this trimmer are made: No. 1 trims from 10 to 18 feet, size 5x20. No. 2 trims from 6 to 20 feet, size 5x22. These trimmers are first put together and finished ready for running. They are then taken apart, and each piece marked so that any mechanic can put them together, or they can be shipped all put together, as may be desired.

It is claimed that No. 2 will trim from 75,000 to 85,000 feet per day without crowding.

Both of these machines are manufactured by the inventor, D. J. Murray, of Wausau, Wis. (a point of importance in the lumber business), and have become popular in that locality.

The Syracuse *Journal* says:—A recent invention in the shape of a brake for a locomotive will greatly increase the safety of travel and lessen the number of railroad accidents. The invention was given a thorough trial recently. The engine (light) was started with 130 pounds pressure on its boiler, and proceeded on a level track at a speed of twenty-five miles per hour; the reverse lever was in the extreme forward notch. At a given point the throttle was opened to its fullest extent, at the same time the brake was applied, and immediately thereafter sand was thrown on the rails. The result was the engine stopped dead, with the throttle wide open, within ninety-six feet from the point where the brake was applied.

The latest wrinkle in steam yachts is an iron steam catamaran, an idea stolen from the South Sea Islanders, to be built by parties in Nyack, N. Y., for Commodore William Voorhies, of yacht club fame.

New Orleans grain receipts were much the largest ever known during the week ending Jan. 31 last, when they amounted to 1,120,063 bushels, which is nearly as much as during the four weeks previous, and more than its average *monthly* receipts in previous years.

In Washington, Feb. 6, the House Committee on Patents decided to report adversely on the application for an extension of the patent on the Miller railway platform and coupler, on the ground that the 17 years it has run is long enough, and that the patentee has received sufficient remuneration already.

Tennyson spends hours on a single line. But that's nothing. We have known men who spent their whole lives on a single line. They were generally conductors.—*Philadelphia Bulletin.*

Stearns Mfg. Co., Erie, Pa., write us: We advertised in your "Wanted" column for 50 machinists, and, as a result, have put on nearly 150 men, many of them desirable hands. We are running from 12 o'clock Sunday night till twelve Saturday night.

The Clinton Stove Works, of Troy, N. Y., have made a general advance of wages to their employees, the advance to date back to February 2.

The frequent and important sales of coking coal lands in the Connellsville district indicate most clearly the growing confidence in coke as the future blast-furnace fuel.

A peculiar velocipede is used on railroad tracks in Kansas by telegraph repairers. It has two wheels, like a bicycle, which run on one track, and over which the rider sits, while a smaller wheel, for steadying, rests on the other track. Twenty miles an hour is practicable with it.

Advantages of High Speed Engines.

BY CHARLES T. PORTER.

No. 11.

Asking pardon of my readers for the delay in completing these papers, I beg to assure them that we are now going to have a change. I have said all I intend to say on the action of the reciprocating parts, and now, having had a good rest, let us take up another branch of this great subject, and consider how the utility of the fly wheel is enhanced by increase of speed.

I shall never myself cease to wonder at the apparently exact, and really very close approach to exact steadiness of rotation, that is attained in high speed engines with fly wheels so small as to seem almost ridiculous. When such engines come to be applied to drive machinery requiring very uniform motion, or of a character to show exceedingly small variations, the rotation always appears to be as steady as that given by a turbine wheel.

Practical men have little patience with the discussion of theories that have never been tried, but a search for the "why" of facts, the reality of which has been well established, has always a real and substantial interest, and is, moreover, the only way by which our knowledge of mechanical truth can be enlarged.

The explanation of the steadiness of rotation of high speed engines, a steadiness beyond what is by any means attainable in single engines running at slow speed, is two-fold. There is, first, the equalizing action of the reciprocating parts, which we have been considering at so much length, and which, when correctly developed by a good combination of weight and velocity, leaves to the fly wheel only a supplementary action; and, second, the fact that, practically, the regulating power of the fly wheel increases as the cube of the speed.

"That," says the reader, who has made a special study of this subject—"that is not so; the *vis viva*, or living force, or momentum, or work stored up in a fly wheel, varies only as the square of the speed."

Yes, my friend, very true; and, nevertheless, the practical fact is as above stated. An illustration will make this clear: Suppose, in place of an engine making 50 revolutions per minute, one, proportionately smaller, is substituted, to do the same work and make 150 revolutions per minute with the same fly wheel. The absolute regulating power of this wheel is increased as the square of the speed, or nine-fold—that is all. But as we have, doing the same work, an engine making three times as many strokes per minute, it necessarily follows that on each stroke it will exert only one-third as much force. Either the area of the piston, or the length of the stroke, or the product of the two multiplied together, is only one-third of what it was in the first engine. One-third of the force means one-third as great inequalities of force to be compensated by the fly wheel, and so, practically, relatively to its duties, its value has been increased three times nine, or twenty-seven-fold—as the cube of the speed.

Let us look at this action again from another point of view. Suppose the last-named engine to be run, at first, at only 50 revolutions per minute, and to be provided with a fly wheel sufficient to give to it a satisfactory motion at that speed. Clearly, this fly wheel would not do for the engine three times as large, making the same number of turns per minute. The latter would require, to give it the same approximate steadiness, a fly wheel of three times the controlling power.

But now let the little engine be speeded up to 150 revolutions per minute, and exert the same power as the large one at 50 revolutions, which it will do if the steam is distributed as well, as is proved in many engines running, and now its fly wheel, which, at 50 revolutions, was only one-third large enough for an engine of this power, has become nine times too large.

The power increases directly as the speed increases; the weight required in the fly wheel diminishes as the square of the speed increases; and so the fly wheel required for an engine of given power varies as the cube of the speed.

There is, however, another side to this matter. We have assumed the fly wheels, in the cases compared, to be of the same diameter. But it is found desirable, in practice, to reduce the diameters, and that very much. Now we discover that large diameter has been the vitally important feature in the fly wheels of what we now call slow speed engines.

The regulating power of a fly wheel of a given sectional area of rim varies as the cube of the diameter. This will be obvious on reflection; for, first, the weight of the rim varies directly as the diameter; and, second, the momentum of each pound varies as the square of the diameter, which—the revolutions being the same—is only another name for the velocity. So, if, with a given number of revolutions per minute, we double the diameter of the fly wheel, and keep the same sectional area of rim, for each pound, with momentum 1, we have two pounds, each having momentum 4.

If, then, we wish, in the case first supposed, to reduce the diameter of the fly wheel to one-third, say, for example, from 24 feet to 8 feet, we must keep the same sectional area of rim. But what a wonderful thing this is, to be able to substitute an 8 feet in place of a 24 feet wheel!

We may increase the diameter to 10 feet, and would, in practice, do so; and this slight enlargement enables us to reduce the sectional area of the rim by one-half, for the cube of 10 is almost exactly twice the cube of 8. So, in place of a wheel of 24 feet, we have one of 10 feet diameter, with about one-fifth the weight of rim, and, in combination with the reciprocating parts, giving a far steadier motion.

I have employed for these illustrations a speed of 50 revolutions in contrast with one of 150 revolutions, because this is just about the change that the next twenty-five years is to see generally made.

Wages at the Whitinsville, Mass., cotton mills have been raised 4 per cent.

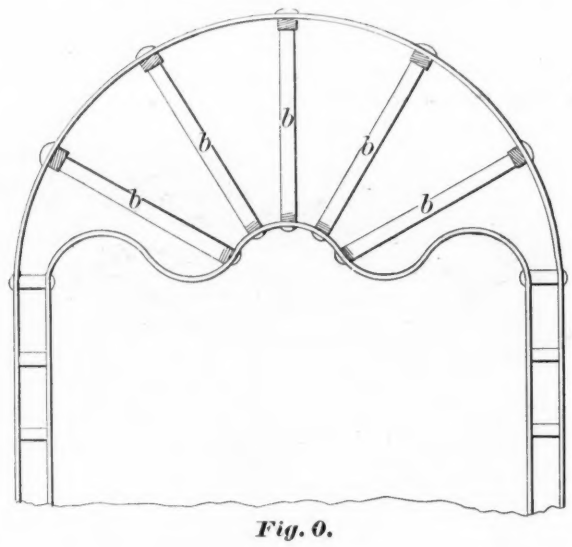


Fig. 0.

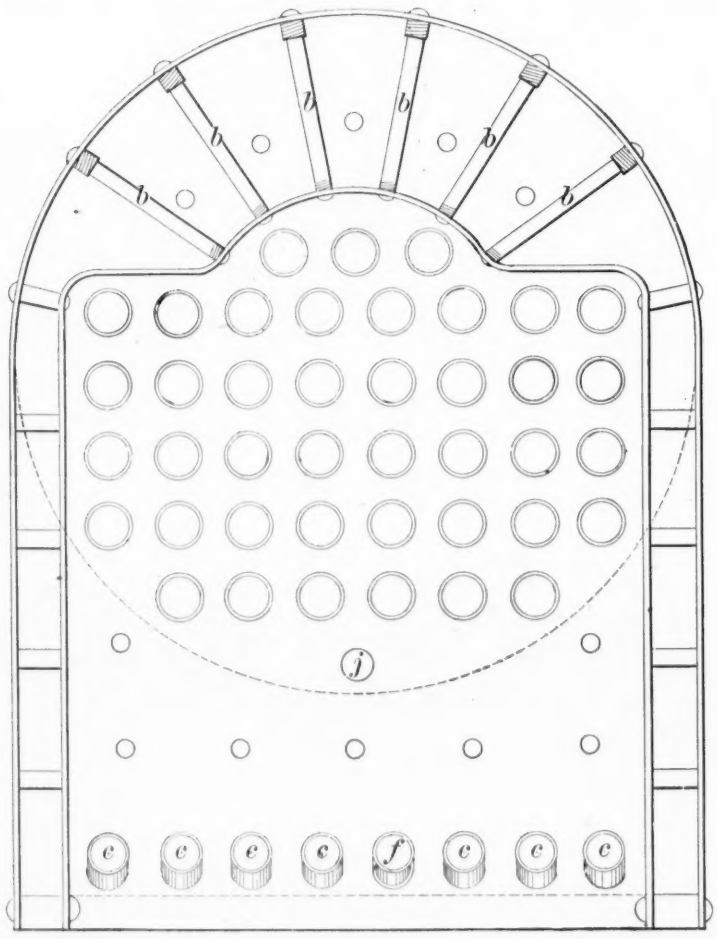


Fig. 1.

Details of a Simple Farm Engine.

BY F. G. WOODWARD.

I present herewith some further details of the farm engine illustrated in the American Machinist, Vol. 3, No. 7:

The boiler is of the locomotive type, having some peculiarities which are applicable, of course, to other boilers of this class. Fig. 1, is a vertical cross section through the fire-box at the dotted line, *a*. Fig. 2, a bottom plan of the furnace end of boiler. It will be noticed, Figs. 0 and 1, that the crown-sheet of the fire-box is formed concentric with crown of the boiler, so that the stay-bolts, *b*, shall enter both sheets radially, or at right angles, as shown. In order to insure a perfect job, the taps for these bolts must be made so as to thread both sheets at the same time, and so that the thread in one sheet shall coincide with that in the other, the same as if the tap had a continuous thread from sheet to sheet; and then the bolts must, of course, be threaded in like manner so that they shall follow (and fill snugly) the threads in the sheets. There is no need of cutting a continuous thread on either tap or bolts in order to meet this condition. A similar precaution is necessary in tapping for the water grate *c*. The stem of the tap must extend across the fire-box in the position to be occupied by the grate-tube, and must be held steadily in that position while the thread is being cut in the sheet, so that the tubes shall all range parallel with each other when screwed in, without causing any side strain. There are several methods of fixing grate tubes into the fire-box, but the two best methods will be explained hereafter.

Among the excellent rules given by the Hartford Boiler Inspection and Insurance Company, for the guidance of steam users, is the injunction to "keep boilers free from sediment." This rule is certainly one of the most important. The accumulation of mud in the narrow water spaces about the fire-box and beneath the tubes and flues, is one of the most potent sources of trouble and danger, and the best possible means should be provided for the frequent cleaning out of these spaces. A blow-cock is of but little use for this purpose, as its action upon sediment extends but five or six inches from its opening.

A screw plug placed at each corner seems to be the handiest means yet devised for this purpose, and they should be placed (as shown *d*, Fig. 2) so that a scraper may be run in to the extent of each space, both cross and lengthwise of the boiler, and the plugs should be placed as near the bottom as possible. A screw plug should also be placed in the smoke-arch, beneath the tubes opposite the dot circle *J*, and at *s*, also. If solid plugs are used, the scraper should have a wooden handle, as iron and steel rods are sure to damage the threads of the plug holes. A better style of plug is shown in Figs. 5 and 6. The thimble *g*, is screwed permanently into the boiler, in place of the solid plugs *d*, and the cap *h*, may be either screwed on, as shown in Fig. 6, or held on by a yoke and set screw *i*, as in Fig. 5. A screw plug must also be placed at *e*, opposite each grate tube. One of the grate tubes may be movable, as shown at *f*, to facilitate cleaning out the furnace, the outer and inner sheets of the fire-box being united by a screw thimble *m*, for the reception of the movable grate tube; or a solid bar may be preferable to a hollow one, if very long. Hollow stay bolts are frequently used, as shown at *n*, for the two or three first rows above the fire, to promote combustion and to prevent the powerful draught (caused by the exhaust), from breaking up the fire; but I cannot say to what extent or under what conditions this practice is beneficial.

Fig. 7 shows a convenient form of steel scraper, three views, for cleaning out sediment, *o* a wooden handle. The blades *k*, are made of spring steel, and are capable of contracting so as to pass through a 1¼ inch hole.

Advances in Wages.

Beymer, Bauman & Co., and C. F. Wells & Co., two Allegheny, Pa., white lead firms, have advanced wages ten per cent.

The Old Colony Iron Works shovel shop at East Taunton, Mass., has been enlarged and this department is employing an unusually large force. The wages of the employees of the establishment have been advanced twice since the first of the year.

The four cotton mills at Newburyport, Mass., have voluntarily increased the wages of their operatives about 10 per cent.

The Carver Cotton Gin Company of East Bridgewater, Mass., have increased the pay of their operatives.

All the coal operators of the Cumberland region of Maryland have yielded to the demand of the miners for another advance of 15 cents, and the men resumed work at 65 cents per ton.

The Gosnold Mills at New Bedford, Mass., intend to increase the wages of most of their employees about 10 per cent.

Sayles, Owen & Co., of Warren, Mass., raised the wages of their help March 1.

Daniel E. Paris, stove manufacturer of West Troy, N. Y., has advanced his workmen 15 per cent., and says the market will afford more than that.

The wages of the varnishers and fillers employed at the bedstead factory of Siebert & Co., Pittsburgh, Pa., were advanced lately to the extent of from 5 to 7 per cent.

The employees of the piano factory at Astoria, L. I., have been granted an increase in wages of 18 per cent.

The wages of the molders in Harrison & Kellogg's malleable iron works, Troy, N. Y., were advanced 15 per cent.

Burdett, Smith & Co., of Troy, N. Y., have advanced the wages of their molders five per cent. more, making 15 per cent. in all.

The puddlers of the Tredegar iron works, Richmond, Va., have been advanced to $6 per ton.

Swett, Quimby & Perry, of Troy, N. Y., have advanced their molders' wages 15 per cent.

The molders in the employ of the co-operative stove works, recently asked the superintendent for an advance of five per cent. in wages, and it was immediately given them. This makes a total of 15 per cent. advance given since the beginning of the year.—*Troy Evening Standard*

Several of the furniture manufacturers in New York have advanced wages.

L. Pomeroy & Sons, Pittsfield, Mass., have recently advanced the wages of all the employees at their woolen mills 10 per cent., and by a revision of the lists some of the weavers make nearly 20 per cent. more per month than they did a few months ago.

The Griswoldville Manufacturing Company, Turners Falls, Mass., have advanced the wages of their Coleraine help ten per cent.

Four of the largest mills of Portsmouth, N. H., have made an increase of wages of from six to ten per cent.

The Union Steam Forge Company of White Hill, N. J., have increased the wages of their men thirteen per cent., and their works are running night and day.

The employees of the Cable flax mills of Hart's Falls, N. Y., received an advance of 10 per cent. in wages.

The wages of the girls and boys in the Germania mill spinning room, Holyoke, Mass., have been raised 10 per cent.

The Hadley Company, Holyoke, Mass., raised the wages of their employees 10 per cent. March 1.

There has been a general advance in the wages of stove molders in Philadelphia who are now making from $2.80 to $3.50 per day.

From the 1st day of March the wages of the officers and employees of the Lake Shore and Michigan Southern Railway Company were restored to the old rates paid prior to the reduction of ten per cent. which was made in July, 1877. The increased pay applies also to the officers and employees of the New York Central, and Hudson River Railroad Company, to whom a similar notification has been made by W. H. Vanderbilt, president of both the lines in question.

At Lowell, Mass., there has been a general advance in wages by all the leading corporations within a few weeks, and several manufacturing establishments have joined in the increase, which was agreed to by the manufacturers without any petition or other movement.

An increase of fifteen per cent. in the wages of moulders took place in two of the Troy, N. Y., foundries, on Saturday, Feb. 28th.

Wages have been advanced twenty-five cents per day in the moulding rooms of the Holly Manufacturing Co.'s shops at Lockport, N. Y.

The Schumacker Piano Company, Philadelphia, has increased the wages of its employees ten per cent,

The lathers of New York City, who have heretofore received $1.50 and $1.75 a day, struck for $2.25 and $2 50, which was conceded by the bosses.

American vs. British Locomotives.

The above is the title of a new pamphlet, compiled and written by Walton W. Evans, which contains correspondence respecting the relative merits of American and English locomotives. The report was presented to the Government of England through their Agent-General for New Zealand, Julius Vogel.

We herewith publish extracts from the letter of R. M. Brereton, Engineer-in-Chief of the Great India Peninsular Railway.

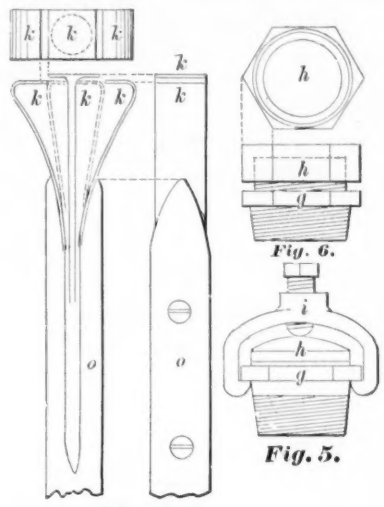


Fig. 7.

Fig. 6.

Fig. 5.

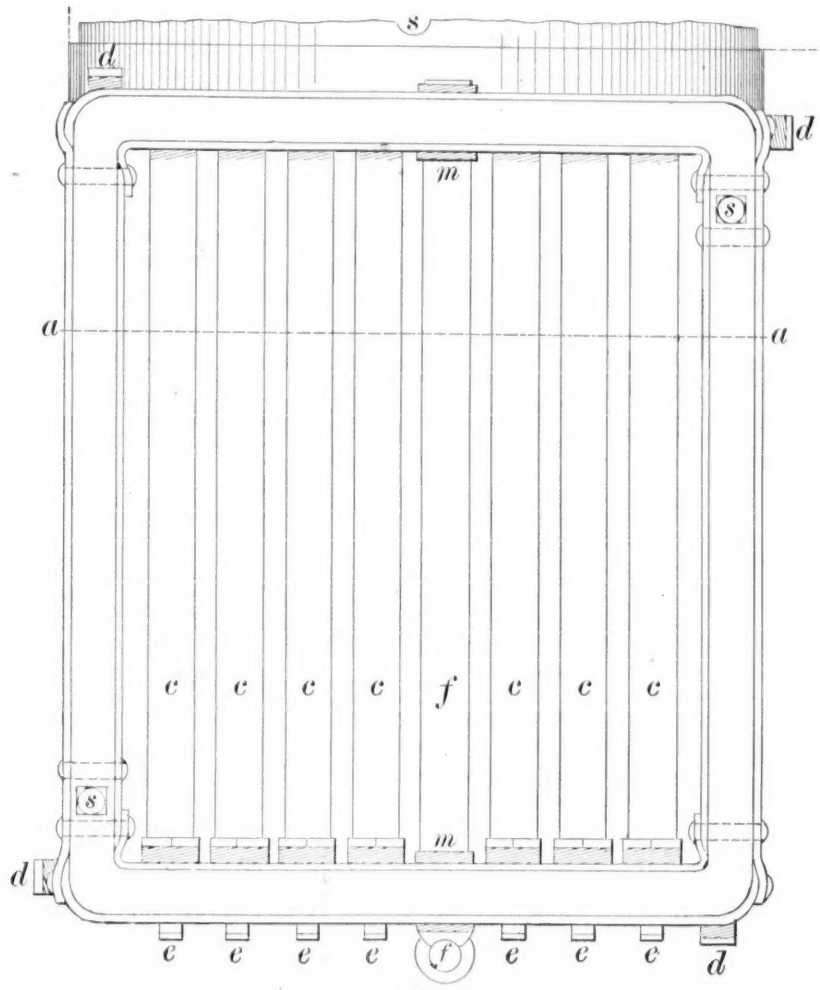


Fig. 2.

Mr. Brereton guarantees the correctness of his statements, as they have been a source of careful study by him for the past eight years. He further says:

During the past twenty-six years I have spent fourteen years in India, in the construction and working of one of the principal guaranteed railways, besides four years in this country, and nearly eight in the United States, so that I am able to compare the working results in each country from the standpoint of experience. I have come to the conclusion that we can and ought to construct, equip, and work our railway system in India, in our several colonies, and in this country too, in a far more economical manner than past experience *here* has shown to be possible, or our consulting engineers, managing directors, and agents (who have not had the opportunity of studying the working of the 77 470 miles of railway of the United States) have hitherto believed to be possible.

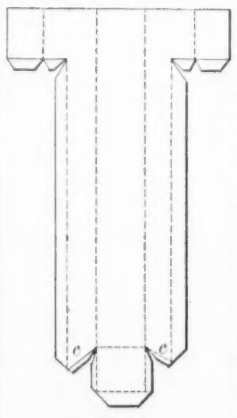


Fig. 4.

In regard to locomotives, the Americans certainly obtain from 8,000 to 10,000 train miles greater duty per annum than we can in this country or in India, and this too under the following drawbacks: Inferior roadbeds, steeper gradients, sharper curves, more severe climate, heavier loads hauled, and less speed in running.

The greater duty obtained cannot be due to better workmanship and superior materials, because it is well known that the English mechanic in skill of hand cannot be excelled, and the very best materials are employed by our English builders, and the hours of work in both countries are nearly the same. Hence, I argue that the greater duty done by the American motor is due to the better design and the better system of working the locomotives. The American builder excels in the system of framing and counterbalancing, and in the designs of the crank, axles, &c., so that the engine may run remarkably easily and without jar round sharp curves, and work not only the light roads, but also diminish the wear and tear on the solid roads, and, at the same time, increase the effective tractive force.

The English engine is a very heavy affair, and, in running, it not only wears and tears itself very rapidly, but also the roadway, and it greatly, by its unsteadiness and jar, fatigues the drivers and firemen. I have ridden hundreds of miles on engines in India, in England, in France, and in the United States, and I have always found the American engine most easy and comfortable, but I never did the English or the Continental engines. * * * *

It is almost impossible to give these engines their full hauling power, simply because the greater portion of the weight cannot be thrown on the driving wheels.

Another point I have to make is the mistake we make in adhering so obstinately to our old-fashioned system of running the engine with only one crew. Every one who understands the construction and powers of the engine must see that it is capable of a far higher average annual duty than 16,000 to 20,000 train miles. The engine should be kept in steam as long as possible, in order to avoid the wear and tear due to expansion and contraction which ensue under the present system of daily drawing the fires. The continuous running system would save considerably the present consumption of fuel in the daily getting up steam. They do not find in America that the double crew system involves any greater cost in repairs and renewals; indeed, the life of their engines compares most favorably with the life of engines in this country and on the Continent.

The duty of the driver is to run his engine and keep her in order on his daily trip from depot to depot; he has nothing to do with her in the stable or depot; there she is cleaned, repaired, and got in steam by other hands employed for that purpose. When one crew have taken the engine over their daily stage, another crew run her on, and so they oscillate to and fro, the engine stopping only for repairs and to be washed out. Mr. Juland Danvers's report for 1876–77 shows (on page 11) the number of engines on the whole of the guaranteed railways in India to be 1,425, and (on page 31) that the train-miles were 21,609,411, which gives an average of only 15,164 miles per engine. Deducting say 33 per cent. from the days of the year for the monsoon season, and for repairing days, there are then 240 days in which the engine should be capable of running 10 to 200 train-miles per 24 hours, or from 24,000 to 56 000 train-miles per annum. Mr. Danvers's report, however, shows that the average mileage per engine was only about 60 miles per 24 hours for, say, 240 days.

From the official returns of the Hudson River Railway, I find that thirteen of the engines in 1877 made a combined monthly average of 6,238 miles for the entire year; four of these ranging from 7,104 to 7,218 miles per month, while the average for the year of all the 97 engines in service was 38,422 miles per engine. One engine in 15 months averaged 7,858 miles per month, or over 255 miles daily for 461 consecutive days, including Sundays The total life of these thirteen engines was 98½ years, which gives 39,948 miles per annum for each engine for their entire life. The cost of these engines in repairs per mile run was $2\frac{7}{10}$ cents, which is equal to less than $1\frac{4}{10}$ pence per mile.

Mr. Ely, the Locomotive Superintendent of the Pennsylvania Railroad gives the following data in reference to twenty of their engines on the heaviest portion of their system over the Allegheny Mountains for the year 1877:—Ten passenger engines' average annual mileage was 45,554½, and cost of repairs per mile run was 3.48 cents; ten goods engines' annual mileage was 32,574½, and cost of repairs per mile was 3.65 cents; general average of all twenty engines was 39,065½ miles per engine, and the cost of repairs per mile run was 3 56 cents. One of their passenger engines, No. 133, averaged 237½ miles daily for an entire year (1872). This engine ran in 1869, 44,616 train-miles; in 1870, 42,900; in 1871, 54,139; in 1872, 86,724; in 1873, 41,979; and in nine years' run it averaged 47,528 per year. Another of their passenger engines, No. 914, ran, in 1874, 60,604 train miles; in 1875, 58,344; in 1876, 57,225; in 1877, 49,257. A goods engine No. 447, ran, in 1870, 41,184 train miles; in 1871. 44,108; in 1872, 42,537; in 1873, 36,877; in 1874, 35,580; in 1875, 36,508; in 1876, 45,529; in 1877, 39,193. This makes an average of 40,189 miles for each of the eight years this engine has been running. On the Erie Railway, Mr. H. J. Jewett, in an official letter, dated 8th April, 1878, gives the following mileage of four engines built by the Rogers Locomotive Works, of Paterson, New Jersey:

	Mileage.	Placed in Service.
Engine No. 201..	635,169..	9th June, 1854
Engine No. 202..	632,548..	26th June, 1854
Engine No. 203..	658,548..	15th July, 1854
Engine No. 204..	539,186..	29th July, 1854

These engines had new boilers in 1871, the original boilers running seventeen years. He reports these engines good for eight years' more service at least. He also reports two other Rogers engines, No. 313 and 327, as running with their original fire-boxes since 1865, or thirteen years. The above-mentioned mileage gives an average for the twenty-four years of 2 ,677 miles per engine You will observe that these engines on the different railroads must have been well constructed in the first instance, that they could not have been long in the repairing shops, and that they must have been kept in good running order notwithstanding the high duty they actually performed. This is really very remarkable, when you consider the very severe winters of the Middle States, and how destructive snow is to machinery, as well as Jack Frost, when it breaks up in the spring.

We will continue extracts from this report in our next issue.

An improved form of watch, indicating the day of the week and month, and the phases of the moon, has been recently brought before the French Society d'Encouragement. It is the invention of M. Crozet, and the extra cost of its production is but small.

A foundry is to be established in Vineland, N. J.

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NEW YORK, MARCH 20, 1880.

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The Panama Ship Canal.

The greatest engineering work now in progress in the world is unquestionably the cutting of a ship canal across the isthmus of Panama, thereby opening a direct roadway for the commerce of the nations between the Atlantic and the Pacific, thus shortening the water route now followed some thousands of miles. The direct benefit the successful completion of this gigantic work will confer upon the people of both Europe and America is incalculable. An isthmus only about 40 miles in width separates the two oceans. Some years after the discovery of gold in California, a railroad was built across this isthmus, which achievement was, at that time, considered, owing to the difficulties to be overcome, a great triumph of engineering skill and perseverance. It was esteemed a work of international importance. With how much greater interest, then, should be regarded the colossal enterprise of opening a permanent highway for the vessels of all nations through this natural barrier to the water commerce of the world? To carry forward this undertaking only private capital is relied upon; and its projector, M. Ferdinand De Lesseps, deserves to rank as the most progressive engineer of the times. That the project is not a chimerical one, nobody need have a doubt who will inquire into the magnitude of the Suez Canal, which was originated and pushed to a successful completion, after a fifteen years' struggle by this indomitable Frenchman. The Panama ship canal, though its estimated cost is $170,000,000, presents fewer engineering difficulties than that of Suez.

The visit of M. DeLesseps to this country to awaken the interest of the American people in his canal enterprise seems to be very successful. We had the pleasure of being present at the dinner given to M. De Lesseps by the citizens of New York, March 1, and listening to a number of addresses upon the absorbing topic under consideration. The great engineer pithily said: "Science has declared in favor of the canal, and I am the servant of science, and I promise to place America in a position where 25 years from this day she shall be the Queen of the Seas." One of the most pointed and entertaining addresses on that occasion was that of Mr. A. L. Holley in response to the toast: "Engineering—The intermediate power between nature and civilization." He said:

Mr. Chairman: The sentiment you propose so completely defines the master art of engineering, that it needs no historian, no prophet, no defender. It were better, to-night, that we magnify its splendid achievements, as we celebrate the advent of its illustrious apostle. It is such grand conceptions as his, such triumphs over difficulty, such faithful and brilliant execution, that draw the members of our profession to him; but our profession it is that draws the whole world in its triumphal march. The ways and means of transportation, of mining, metallurgy, manufactures, defence, agriculture, architecture—all the round of vital and useful arts—are but phases of engineering effort.

But engineers are not proud; they simply cannot help it that they are the way, the vehicle, the power of civilization. They even acknowledge the incidental value of other professions. Chemistry is a noble art—full of promise—but only complementary to engineering. Engineers are, for this reason, sometimes complimentary to chemists. Commerce, banking, jurisprudence, political economy, government, are more or less useful systems—for what? For formulating and realizing the potentiality of engineering. And so the noble art—stimulating labor, promoting comfort, founding prosperity, diffusing happiness, establishing knowledge—blends, in its own potency the aims of the three learned professions of old, and itself leads on to universal health, equity and virtue.

I do not wish to be understood, sir, as claiming much for engineering; so sensitive is the modesty of my colleagues, that they would not tolerate an overstatement of its claims.

Viewed from my own department of the profession, there is but one aspect in which the achievements of our distinguished guest are not supremely beneficent. He delves in rock and earth; alas, he constructs not in iron and steel. Unhappy iron and steel! Could he but restrain his insatiable ambition to reconstruct this planet; could he but intersperse his mighty works with some trifling steel railway from New York to China; some trivial steel bridge from his own beloved shores to Albion, he would be enshrined as little less than a divinity, even in Pennsylvania. But although not a constructor in steel himself, he is a cause of steel construction in others. The canal breeds ships.

And here I may, perhaps, be permitted to emphasize one engineering condition of a transcontinental canal, common alike to all countries and to all routes. The ship grows from year to year. The early Atlantic steamers were of 1,000 tons; the building Atlantic steamers are of 8,000 tons. This growth is by a law as inevitable as that of the tides. Doubling the lineal dimensions of a ship increases her resistances fourfold, but it increases her carrying capacity eightfold. The larger ship can thus transport the greater cargo at the higher speed, and at the minimum cost. There is but one practical limit to this economy—it is the size and directness of the water way.

I was not called upon, however, to discuss engineering, but to praise it. Do we ever realize the gigantic difficulties it overcomes—its uncompromising struggle with nature, oft baffled, ever renewed, to ferret out the secrets of her power? Do we ever picture to ourselves the engineer, toilfully planting his colossal works on precipitous mountains, in the open sea, under the river bed, in the bowels of the earth, on bottomless and pestilential swamps—amid perils of miasm and fire damp, wind and wave, caisson and explosion—with every toppling avalanche, and every subterranean stream and every pent up freshet just waiting to crack his bones and wipe out his works?

As you hold on to some headland against the hurricane, and feel the breakers shake the masonry of nature, his steamship plows its huge canal through forty thousand tons of that maelstrom in one single minute, with the coal one man can carry. The treasure-house of nature he despoils with his hydraulic engine; he raises from the dead the iron she had burned up through the ages. He disparts her continents to make way for his argosies, and spans her sea for his chariots of fire. Thus is engineering truly the intermediate power between nature and civilization; and from this high plane we recognize the guiding genius of our illustrious guest, and bid him hail!

Progress in Mechanical Engineering.

The progress made in the art of mechanical engineering is nowhere more fitly illustrated than in some statistics regarding the cost of constructing the new St. Gothard Tunnel, recently bored through the Swiss Alps, as compared with the cost of similar undertakings elsewhere. The Hoosac Tunnel, in Massachusetts, 4¾ miles in length, cost $13,000,000; the Mont Cenis Tunnel, in Italy, almost 8 miles, cost $15,000,000, and the St. Gothard Tunnel, 9¼ miles, cost less than either of them—namely, $9,000,000. The favorable nature of the comparison is largely to be attributed to the improved drills and other tools and mechanical appliances used. This result has been further accomplished in spite of vexatious caving in and the bursting out of torrents in many instances. Up to date the St. Gothard Tunnel is the longest in the world.

Machine Shop Wages.

The rates of wages paid in machine shops vary considerably in different localities and so does the cost of living. If board, house rent and supplies were as cheap in New York city as in some country towns, machinists would do unusually well here. A large number of shops have made no general advance for two or three years, but some of them have been paying liberal rates to good workmen when business was slack as well as when it was brisk. Some who pay very moderate wages object to granting any advance until they fill contracts taken when prices were much lower than at present. This kind of logic will pass with mechanics who can not do better, but so far as heard from it has no effect upon those who furnish supplies either to the manufacturer or the workmen. There have been rumors of boiler makers striking in this city, but they can not be traced to any reliable source. The rumors have no foundation. We give below rates of wages paid in a number of Pennsylvania and New York city shops.

PENNSYLVANIA SHOPS.

The Vulcan Iron Works (Boilers and Machinery), Wilksbarre, pay machinists $1.50 to $2.00 a day; molders, $1.50 to $2.00; boiler makers, $1.50 to $1.80; pattern makers, $2 00 to $2.25; blacksmiths, $1.75 to $2.25; laborers, $1.15. They employ 125 workmen.

The Lebanon Manufacturing Co. (Machine Shop), Lebanon, are now paying skilled men the rates per day printed in the second column herewith. The first column rates are those paid in 1879.

	1879.	1880.
Machinists, best	$1.30	$1.50
Machinists, ordinary	1.20	1.30
Molders	1.30	1.50
Blacksmiths, best	1.75	2.00
Blacksmiths, common	1.20	1.40
Blacksmiths' helpers	.80	1.00
Pattern Makers	1.75	2.00
Foremen	2.00	2.25
Laborers	.80	1.00

The Barnes Manufacturing Co. (Machine Shop), Lanesboro, pay machinists $2.00 a day; foremen, $2.75; molders, $2.25. They are not employing many workmen.

The Dickson Manufacturing Co. (Locomotives, Engines and Boilers), Scranton, advanced wages 10% the first of last December. They now pay iron molders $2.00 a day; machinists, best, $1.90 to $2 00; ordinary machinists, $1.60; inferior machinists, $1.32; machinists' helpers, $1.10; boiler makers, $1 83; boiler makers' helpers, $1.25; riveters, $1.90; flangers, $2.30; blacksmiths, $1.72; pattern-makers, $1.72; brass founders, $2.35; engineers $38 a month.

J. M. Everhart (Files and Engineers' Brass Work), Scranton, has raised the wages of foreman and machinists 20%. He now pays machinists, best, $2 10 a day; blacksmiths, $2.40; brass founders, $1.62; engineers, $1.62; foreman, $2.40.

Merrick & Co. (Iron Foundry), New Brighton, pay molders $2.50 to $2.75 a day; other employes, $1.50 a day. They voluntarily advanced wages to these rates February 1st.

E. T. Cope & Sons (Engines, Paper and Flour Machinery), West Chester, pay about the same wages as in 1878. Iron molders, $1 75 a day; machinists, best, $2; ordinary machinists, $1.50; machinists' helpers, $1.25; boiler makers, $2; blacksmiths, $2; pattern makers, $1.75.

The Central Manufacturing Co. (Agricultural Implements), Lewisburg, pay the same rates of wages as in 1878 and '79. Machinists, best, $1.80 a day; ordinary machinists, $1.25; inferior machinists, $1.10; machinists helpers, $1.00; iron molders, an average of $2.00; blacksmiths, $1 60: blacksmiths' helpers, $1 25; foremen, $2.25; pattern-makers, $1 50; engineer, $1.25.

Frey, Motter & Co. (Boilers and Machinery), York, pay the same wages now as in 1878. Machinists get $1.25 to $2.00 a day; riveters, $1.50; flangers, $1 50; helpers, $1.00. They report plenty of work on hand and have had plenty ever since the panic.

A. B. Farquahar (Portable Steam-Engines and Agricultural Machinery), York, has advanced wages 10 to 15% since 1878. He pays iron molders, $1.65 to 1.75; machinists, best, $2.00; ordinary machinists, $1.50 to $1.60; inferior-machinists, $1.10 to $1.15; blacksmiths, $1.60 to $1 75; blacksmiths helpers $1.10; pattern makers, $1.75; foremen, $3.00 to $3.25; engineers, $1.75.

C. E. Parker (Steam Engines and Machinery), Shamokin, has advanced wages in every department. He pays iron molders, $2.00 a day; machinists, $1.50 to $2.00; foreman, $2.50; blacksmiths, $1.50 to $2.00; pattern makers and carpenters, $1.25 to $1.50.

The Union Stove and Manufacturing Co., Pittston, pays iron molders, $2.50 a day; pattern makers, $2.25, which is considerable advance over wages paid in 1878.

Machinists employed in Lansford, Carbon Co., get $1.50 to $1.75 a day.

NEW YORK.

The Quintard Iron Works (Engines, Boilers and Machinery), foot of East 11th Street, have at present 175 hands No advance in wages has been made since our report in Jan. 1879, but an advance is expected to be made as soon as the contracts, which have lately been received, can be put into working shape. They pay machinists $2.40 to $2.80 per day, with an average of $2.40; boiler-makers, $2;

for riveters, $2.40, $2.50 and $2.60 for setters up, and $2.70 for flange-turners; blacksmiths an average of $2.60 per day, and $1.50 to helpers; pattern-makers, $2.80; draughtsmen, $2.00 to $5.00; engineer, $2.25; yard laborers, $1.40.

R. Hoe & Co., on Grand St., now employ in their mammoth printing press and saw establishment 700 hands, being an increase of about 200 since our last report. They pay machinists $2.25, $2.50 and $2.75 per day; averaging $2.50; blacksmiths, $2.75 to $3 00, and to helpers $1.50; molders, $2.70 average; pattern-makers, $2.50; ordinary laborers, $1.25. Most of these men work by the piece, so it is difficult to give more than average figures. Some of the hands have been advanced from 7½ to 10 per cent. on the above rates since Feb. 1st, 1879, according to merit. There has been no general advance.

Fletcher, Harrison & Co. (Engines, Boilers and Machinery), on West street, employ at present 200 hands, which is 75 more than we reported last year. They pay machinists all the way from $1.75 to $4.00 per day, the average to good workmen being $2.50; pattern-makers, $3.00 to $3.75; boiler-makers from $1.75 to $3.00; blacksmiths, $2.50 to $3.00; laborers, $1.25 to $1.75. No recent advance has been made in wages.

The Delamater Iron Works (Engines, Boilers and Machinery), foot of West 13th street, have at present a force of 500 hands, which is an increase of 75 since our last report. They are quite busy, with a good outlook. They pay machinists an average of $2.25 to $2.50 per day; boiler-makers same as machinists; molders, $2.25 to $3.50; pattern-makers, $2.75 to $3.00; blacksmiths, $2.50 to $2.75, average; engineers, $2.50, $2.75 and $3.25; yard laborers, $1.50. No recent advance.

Marvin's Safe Works are now employing a force of 175 hands, which is an increase of 25 since our last report. They pay machinists $2.00 to $2.50, average; blacksmiths, $2.00 to $3.00; pattern-makers, $2.50; engineer, $3.00; laborers, $1.25 to $1.50. No recent advance.

Herring's Safe Works employ in this city about 200 hands, which is an increase of 50 since our last report. They pay machinists $2.00, $2.50, $3.50 and $4.50 per day; blacksmiths, $2.50 to $3.50 for the best men; safe movers, 40c. per hour. No recent advance.

A. & F. Brown (General Machinery), 57 to 61 Lewis street, employ 60 hands. They pay machinists $2.25 and $2.50 to $3.00; pattern-makers, $2.50 to $3.00; blacksmiths, $2.00; helpers, $1.25 to $1.50. No recent advance.

E. Lyon & Co. (Hydraulic Machinery), 470 Grand street, pay machinists $2.25 to $2.50 a day; blacksmiths, $2.50 to $2.75; helpers, $7 to $10.50 a week. They employ 35 hands and average 75 hours' work per week, the men being paid extra for over-time.

The Morgan Iron Works, John Roach & Son, foot of East 9th St., have a force of 500 hands at work in this city, and 1,000 at Chester, Pa. They have lately made a 5 per cent. advance in wages and will make another advance soon. They pay machinists $2.30 and $2 75 to $3.15 a day, with an average of $2.50 to good workmen; riveters, $2 to $2.10; fitters' up, $2.10 to $2.50; molders, $2.30 to $2.75; blacksmiths, $2.50 to $2 75; pattern-makers, $2.90 to $3.15; draughtsmen, highest, $5.00; engineer, $3.15; yard laborers, $1.50 a day.

R. Dudgeon (Steam Hammers, Hydraulic Jacks and Roller Tube Expanders), has 34 hands, and pays machinists from $2.25 to $3.50 a day; blacksmiths from $2.75 to $3.25 He has advanced wages from time to time.

A Word About Advertising.

We so seldom mention this subject in the reading columns of the AMERICAN MACHINIST, that a word in this direction, in view of the crowded condition of our advertising columns, may not be out of place. Probably there is no technical journal published in the country whose advertising department runs more easily, or more nearly runs itself, than that of the AMERICAN MACHINIST, the explanation being the care with which the paper is read by the practical men who have influence in mechanical matters. Its value has come to be so well understood by advertisers, that, almost without solicitation, our limited space has been overcrowded with advertisements for some months past, and we have been obliged to increase our advertising rates, the advance taking effect March 10th, 1880. This will tend to prevent advertisements from encroaching upon the reading columns, by inducing advertisers in many cases to take less space. While the advertising pages are not the least valuable part of the paper to the reader, showing, as they do, a sort of bird's eye view of the mechanical activities of the time, the AMERICAN MACHINIST is preeminently *a reading paper*, and will be kept so, our intention being to make the paper always of one uniform size, namely, sixteen pages. Taking the happy state of affairs above detailed in connection with the influential character and steady growth of our circulation (which is now over 10,000 copies weekly, as compared with 7,000 eight months ago), the present outlook for the AMERICAN MACHINIST is as full of cheer for our readers as for ourselves.

A Dyspeptic Strike.

One of the points at issue in the recent strike at the Harmony Mills, Cohoes, N. Y., was the time allotted to the men for dinner. The half-hour hitherto allowed for dinner was deemed insufficient by the men, and very justly, as even those workmen who live close by must find thirty minutes a short time in which to go to their homes, partake of a warm meal, be it ever so frugal, and return in time for work, without swallowing their food and drink in a way more suggestive of burned throats and sore stomachs, than of any decent observance of nature's rules. If the children should on any occasion prove fretful, and the housewife find her mid-day meal delayed, if only for a few moments, the man who goes home would be likely to fare worse than the workman who only pretends to take a cold bite at noon. By all means, let the men have their full hour at noon. Employers should remember that dyspeptic workmen produce dyspeptic work. Better is the establishment where health and activity abound, than the shop in which discomfort and disease unite to cause discontent.

A Just Retribution.

The Millers' convention, which is to be held in Cincinnati during the greater part of the month of June next, bids fair to involve the delegates to the national convention of a great political party of the day in a very disagreeable muddle. It is believed that the hotel facilities of the Queen City will be heavily taxed in lodging the millers and their female relatives, all through that month, the more especially as one of the great political events of the year is booked to occur at the same time in the same city; as a result, it is feared that the politicians will be compelled to sleep on the roofs, and under the byways and hedges. Luckily, however, the climate is a mild one, and June is a pleasant month for out-door repose. If Chicago, now, would only brace herself up, and, resolving not to be outdone by her older rival, organize a corresponding demonstration in the shape of any kind of a thronged convocation during the month in which the nominating convention of the other party is to meet, exact and even-handed justice would be done for once on both sides, and the people would be happy.

The foreman of a large Ohio establishment making agricultural implements, in sending some subscriptions additional to a long list forwarded by him previously, writes:

"The contents of your valuable paper have set the boys in the shops to thinking, and improvement in different ways follows."

LITERARY NOTES.*

POCKET COMPANION FOR LOCOMOTIVE ENGINEERS AND FIREMEN.—Containing general rules and suggestions for the management of an engine under all circumstances. By Charles A. Hoxsie, Practical Engineer. 104 pages; bound in cloth, pocket size. Price, $1.50. Published by C. A. Hoxsie, Carolina Mills, Washington Co., R. I.

This book is published particularly for the use of locomotive engineers and firemen, and contains the practical direction for running and keeping a locomotive in order. It is written in a plain practical way, without the use of figures, and well calculated to instruct the general class of men for whom it it is intended. It contains some valuable suggestions to experienced engineers, while the detailed information is intended to instruct those who are uninstructed in handling the locomotive. This is the only practical American work that we have ever seen on this subject, and will doubtless find many friends among the railroad men who are now struggling for promotion.

The following books compose Nos. 47, 48, and 49 of Van Nostrand's Science Series:

"Linkages."—The Different Forms and Uses of Articulated Links. By J. D. C. DeRoos. Translated from Revue Universelle des Mines.

"Elements of the Mathematical Theory of Fluid Motion."—On the Motion of a Solid in a Fluid, and the Vibrations of Liquid Spheroids. By Thomas Craig, Ph.D.

"Theory of Solid and Braced Elastic Arches."—Applied to arch bridges, and roofs, in iron, wood, concrete, or other material Graphic analysis. By Wm. Cain, C.E.

Business Specials.

Forty cents a line for each insertion under this head.

WANTED—Catalogues and Lowest Cash Price Lists of Machinists' Small Tools, Scroll Saws and Scroll Saw Goods, Foot Lathes, Small Steam Engines, Skates (Ice and Parlor), Bicycles, Tricycles and Sporting Goods. Lock Box 126, W. E. Norris, Helena, Montana Territory.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

To Manufacturers.—We are prepared to furnish Recipes and Information on all Industrial Processes. Address Park Benjamin's Scientific Expert Office, 37 Park Row, New York.

John Fish, M. E., Room 23, 8 & 10 Pine Street, New York. Special attention given to Designing and Superintending the Construction of Improved Machinery. Hoisting Engines, Air Compressors, and Pneumatic Motors a Specialty. Working Drawings and Plans, Specifications and Estimates furnished.

See Christiana Machine Co's advertisement, next number.

Lathe Attachments for Milling Plane and Irregular Forms; Taps and Reamers fluted and Gears cut without removing from the lathe centers. For extended description, see AMERICAN MACHINIST, Sept. 13 and 20 issues. Send for circular to Wm. Main, Piermont, N. Y.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) F. W., Holyoke, Mass., asks: What is understood by the term "nominal horse power?" *A.*—The term "nominal horse power" is adopted and referred to by manufacturers of steam engines in order to express the power or capacity of an engine. It is arrived at by taking into consideration the dimensions of the steam cylinder, the pressure of steam in the boiler and the speed of the piston in feet per minute.

(2) F. B. P., Somerset, Mass., writes: I am running a Corliss beam engine of 85 H. P. In setting the valves, is it best to give the bottom steam valve more lead than the top, or should both top and bottom be set equal? *A.*—A beam engine, when properly made, is equally balanced; we therefore see no reason why one valve should have more lead than the other, and advise you to set them equal.

(3) R. V., Elmira, N. Y., asks: Will you give me the formula for the "steam metal" used in the three-cylinder engines which are used in England with good results. They were troubled by the bearings cutting previous to using the so-called steam metal? *A.*—It is difficult to understand what is meant by steam metal, as the term is very indefinite, similar names being adopted in the trade for different metals. We give herewith the proportions of a metal, used with success in England, for the bearings of shafting and other places where great toughness is required: Zinc 35 lbs., tin 3 lbs., copper 1½ lbs., antimony 1¼ ozs. This metal possesses some peculiar qualities, being very strong, and wears exceedingly well. It has been considered a secret, and, we believe, is now published for the first time.

(4) A. G., Hoboken, N. J., asks: Suppose I wish to find the throw of an eccentric upon the shaft of a steam engine, how am I to proceed? *A.*—Measure from the shaft to the outside of the eccentric on the heaviest side, and then on the opposite side. The difference between the two measurements will be the throw required.

(5) J. S., Manchester, N. H., asks: What is the best mixture for cooling heavy shaft bearings? *A.*—An excellent lubricator for heavy bearings is composed of the following: Pure tallow 2 lbs., pure graphite, sugar of lead 4 ozs.; melt the tallow with a gentle heat, add the other ingredients, and stir until cold.

MANUFACTURES.

Black & Clawson, of Hamilton, Ohio, have taken up the manufacture of paper-mill machinery, a new industry in that place. One day lately they received two new orders, one from Columbus, Ohio, and another from Indianapolis, Indiana. They have just completed a machine for the Harding paper company at Franklin, which was constructed for them before the rise in iron at $11,000, but the value of the machine is enhanced by the change of iron quotations. They also manufacture perforators, machines for grinding printers ink, and are contractors for the building of steam engines, having under way twenty-one engines for Hoover & Sons of Cincinnati.

The Enterprise Manufacturing Company, Philadelphia, has begun its new addition, which will cost $75,000. They will then have the largest establishment of the kind in the country.

Some Chester capitalists have organized a company with a capital of $300,000, and propose erecting a blast furnace at South Chester, Pa. Among the stockholders are John Roach, S. M. Felton, S. A. Crozier, Charles H. and David F. Houston.

The Vitrified Wheel and Emery Co. of Westfield, Mass., have been reorganized by the wiping out of the $100,000 of original stock, and formation of a new corporation, with $60,000 capital stock, called the Westfield Emery Wheel Company, of which H. J. Bush is president, and J. H. Mansfield, treasurer.

Cope & Maxwell's M'f'g Co., Hamilton, Ohio, write us: As a matter of news, we would state that we have just made a shipment of two of our large horizontal Plunger pumping engines of one million gallons capacity, to the Southern Colorado Coal and Iron Company, at El Moro, Colorado; also two of our patent Isochronal Plunger pumping engines of same capacity (one of which the entire pump end is of gun metal) for coal mines of western Pennsylvania. We have in progress one large Isochronal Plunger pumping engine, of one million gallons capacity, for same mines. Also four Isochronal Plunger pumping engines for California mines, besides a large number of our stock sizes for various sections of the country. Prices are on the advance, and the outlook for trade seems to grow more promising every day. We have a very large number of inquiries for prices, &c., from all sections of the country. We are continually adding to onr already large facilities for turning out work.

Holland & Thompson, 217 River street, Troy, N. Y., claim to have produced valuable results in the combination of black lead and animal matter for lubricating machinery. In connection with its use they have invented a new squirt-can, which is claimed to force out this compound, or cylinder oil, frozen lard or sperm freely, preventing loss from dripping, and the annoyance of journals heating.

At the Abbot Iron Works, Baltimore, there are over 600 hands now employed, when a year ago there were under 100. Twenty-one puddling furnaces and 16 heating furnaces are running, all in full blast; and the rail mills will be on double turn in a week or two.

Machinists' and Engineers' Supplies.

New York, March 4, 1880.

There is little or no change in the general state of the supply market.

Prices on rubber belting, hose, and packing have advanced slightly since Feb. 18, when the manufacturers agreed upon a list of uniform prices.

J. O. Morse, 76 John street, New York, has advanced the discount on all brass and iron goods, such as cocks and pipe fittings, 5 per cent. on list prices. Iron pipe can be obtained at lower prices, but is expected to stiffen soon.

Some manufacturers of brass and iron goods report their stock nearly exhausted, the demand being equal to, and in some cases exceeding, the supply.

The market is pretty well cleaned out of waste—cop waste in particular, and it is thought the price will advance soon.

Coe's wrenches are difficult to obtain, also machinists' hammers.

A new combination wrench has made its appearance in the market. It consists of a solid forging with a monkey wrench upon one end, and an alligator wrench upon the other. The manufacturer is Curran Dinsmore, 5 Dey street, New York.

The New York Safety Steam Power Co., 30 Cortlandt street, New York, have just issued a new catalogue of 16 pages, which gives full details of their engines and boilers, together with revised price lists.

G. S. Woolman, 116 Fulton street, New York, has issued a new catalogue, which contains 162 pages, describing all kinds of mathematical and drawing instruments and materials. It also contains some valuable instructions upon the use and care of instruments.

Iron Review.

New York, March 4, 1880.

The demand for iron during February was exceptionally large, and greater than January; that, with the disposition shown by speculators to realize on their holdings, has made the market open quieter this week, but there is good reason to believe that any lull will be temporary, and succeeded by a stiffening, if not advance, in prices.

Pierson & Co., 24 Broadway, N. Y., under date of March 4th, 1880, quote prices out of store as follows:

No. 1, X Pig, $42½ per ton; Iron Rails, $68 to $70, according to weight; Old Rails $43 to $44; Fish Plates, 4c. per lb.; Railway Spikes, 4¾c.; Bolts and Nuts, 5½c.; Common Bar Iron, 3 7-10c., basis from store; Refined, 4c., basis; Ulster, 5¼c., basis; Machinery Steel, 7c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c.; Nail Rods, 7c.; Sheet Iron, 5c., basis; Angle Iron, 4 3-10c.; Tee Iron, 4 8-10c; Band Iron, 4 7-10c.; Hoop Iron, 4 8-10c. and up according to size; Horse Shoe Iron, 4 7-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets 30% off in papers, 10% off in bulk.

Boiler-makers supplies: Flange, 6¼c.; C. H. No. 1 Shell, 5¼c., C. No. 1, 4¾c.; Sheets, 4¼c. basis; Boiler Tubes, 5 and 5% discount.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling slip, New York, furnish us the following, under date of March, 4, 1880:

The tone of the Metal Market is decidedly "B arish"—in Pig Tin especially, prices have fallen fully 2 cents per pound, owing to dull trade, full stocks, and manipulation; how far it will be safe to crowd prices it is difficult to calculate; a reaction may take place sharp and suddenly. London quotes Straits Tin, £92.10s.; Singapore, $31. Nominal spot quotations: Banca Tin, 25c.; Malacca & Straits, 22½@23c., as to lots; Australian, Billiton, English Refined, & "Lamb & Flag," 22¼@22½c.; Pig Lead, steady, 6½c.; Antimony, 20@24c., as to brand; Spelter, strong, 6¾c. for American or Foreign; Ingot Copper, 24@24¼c.; Nickel, $1.25; No. 1 Solder, 12¼; "Half-and-half," 15c.

WANTED.

Situation wanted by a first-class Wood Pattern Maker; understands Gear Making; 16 years experience. Address, S. E. B., 104 Stratford Ave., Bridgeport, Conn.

A Practical Machinist of good address, experienced in selling, who has traveled in Western States, Canada and England, desires engagement with some good manufacturing concern to travel. Address, "Steam," this office.

Situation Wanted—By a Practical Steam Fitter of twenty years' experience—a situation as foreman. Thoroughly understands steam heating, high or low pressure, direct and indirect radiation. Would prefer the West. Can furnish first-class testimonials. Can make plans, specifications and estimates of steam heating. Address STEAM, care of Geo. Sargent, South Weymouth, Mass.

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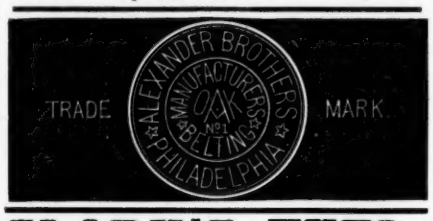

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" Second Cut	10	20		2			10		2						
" Smooth	10						4		2		2	3			
" Dead Smooth												4	12		
Half-Round Rough											10	3	10	6	
" Second Cut	15	15	10							2		2			
" Smooth		20								1	20				
" Dead Smooth	20	10	4	11	2					1	7				
Round Second Cut		8			2			3		1	18	6			
" Smooth	15	6	10	6	10		14	18	15	8	3		6	2	
Four Square Bastard	15				5										
" Second Cut	20			4	5		10	6	30	3		2		4	
" Smooth	20	6	18	4	16		5	4	20	8	10	6	10		
Three Square Bastard													5	10	
" Second Cut								3	4	1	1				
" Smooth															
Hand Bastard	10	4	4	6	50										2
" Second Cut	20	8	6	9	35										6
" Smooth	5		20	4	8			7		20	15	2			
" Dead Smooth	8		9		18				4		3		3	8	
Equaling Bastard									15		6		2		
" Second Cut							6		10		8		4		
" Smooth			2				18		14		16				
Knife Smooth			4						3						
Bastard Second Cut														40	
Taper Saw, Second Cut Single										5			3		
Three Square Parallel Bastard			21	25	10	15	10								
Warding Bastard							20								
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Square " "									2						1
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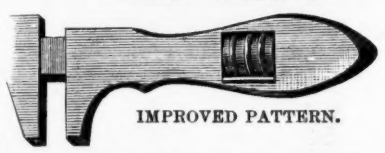
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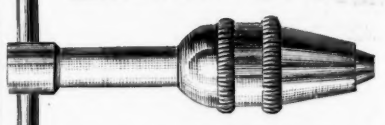
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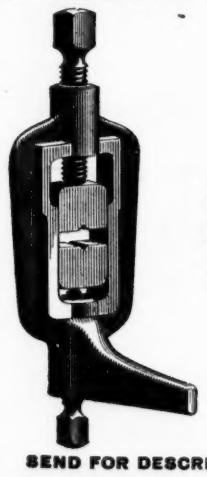

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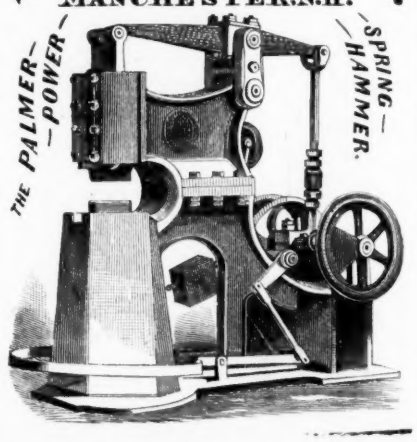

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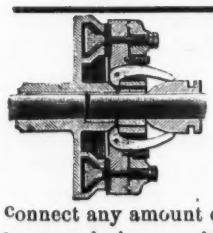

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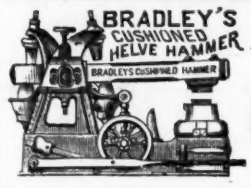

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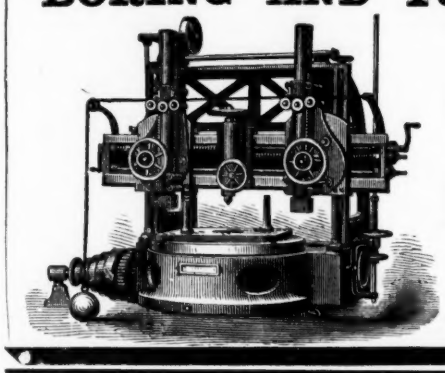

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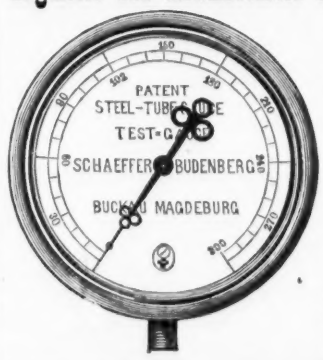

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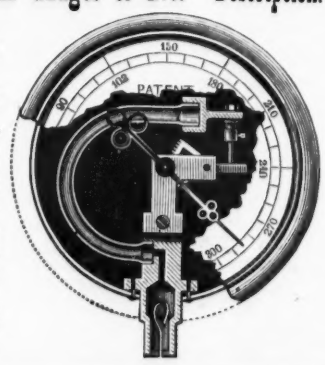

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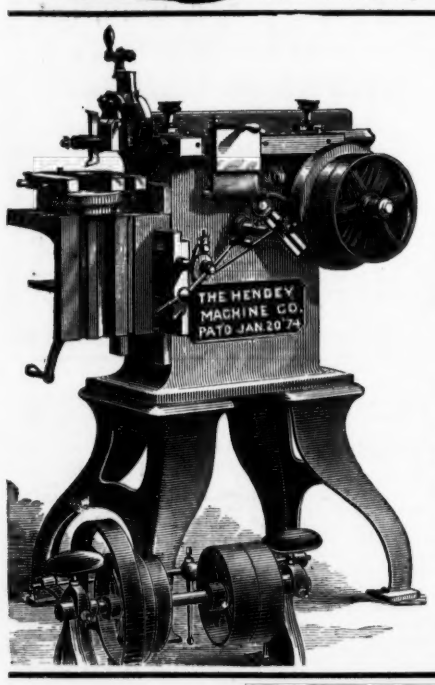

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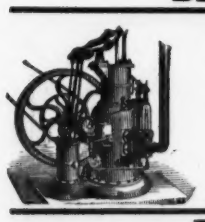

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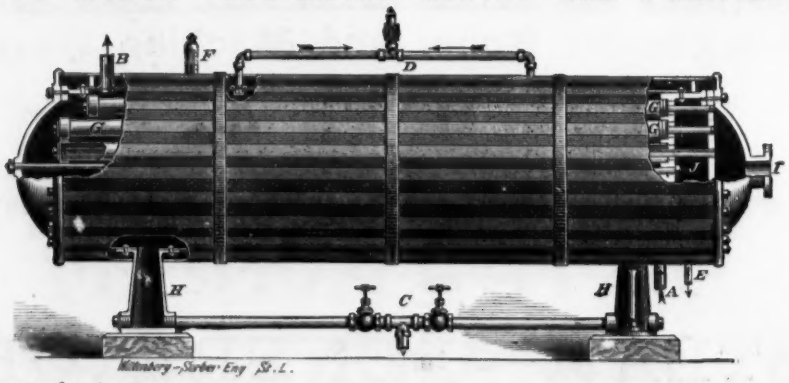

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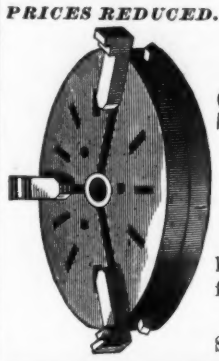

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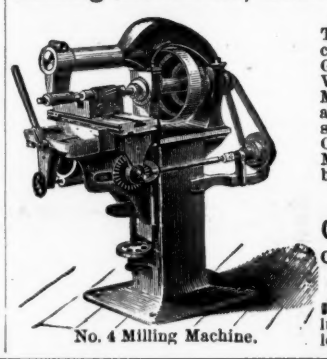

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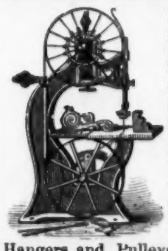

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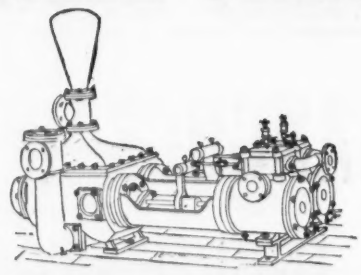

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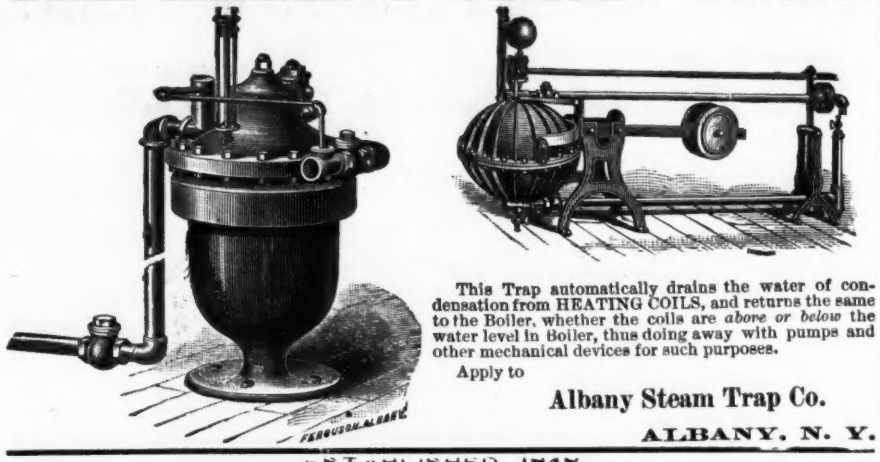

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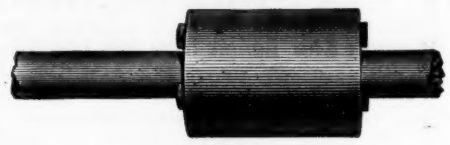

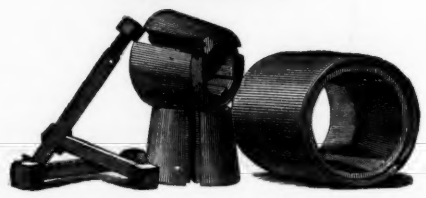

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Loose Pulley Lubricator.

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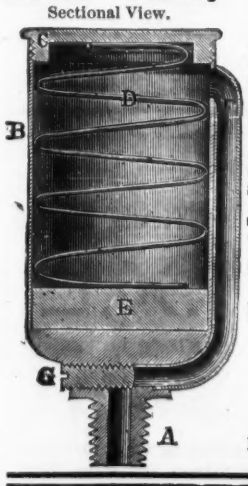

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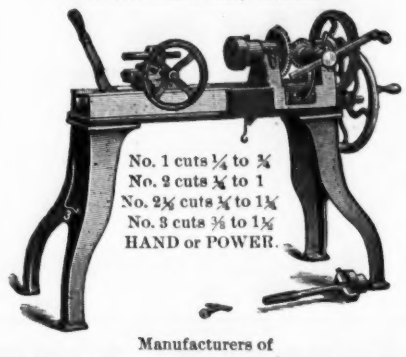

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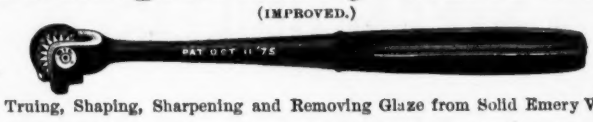

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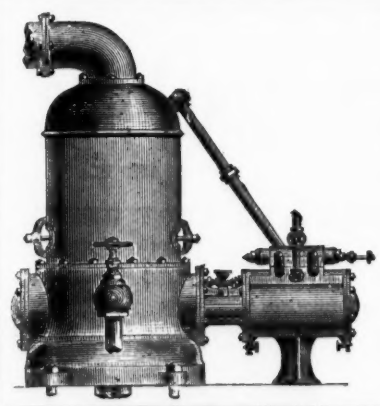

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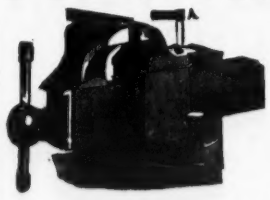

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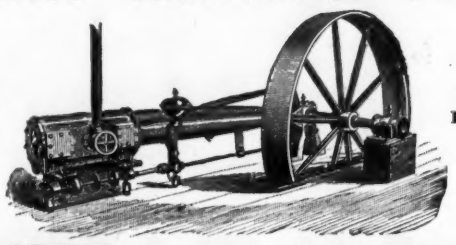

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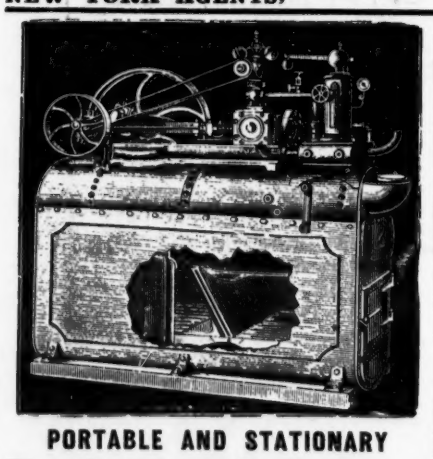

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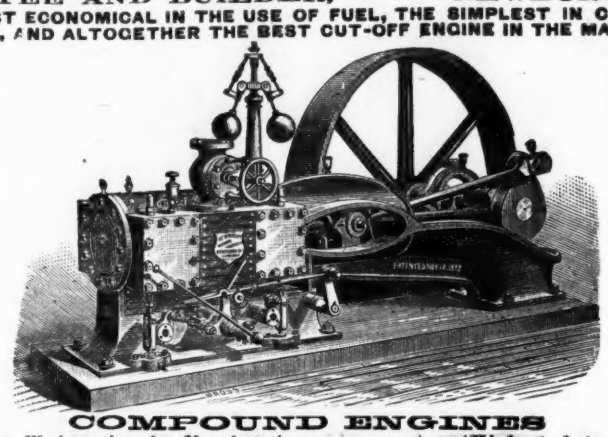

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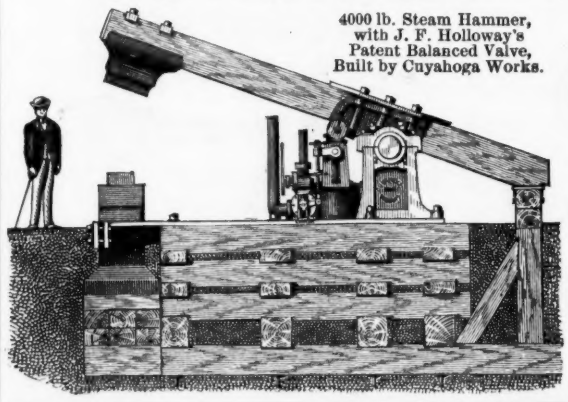
Gentlemen:—In reply to your letter of the 19th instant, I have to say that we have had one of your "Reliable" horizontal engines at work since the middle of October, 1878, up to the present time. It has been used for driving one of your No. 10 Centrifugal Vertical Pumps, and has given us entire satisfaction. The only repairs necessary has been the replacing of the piston packing once.

Yours truly, T. A. MAHAN,
1st Lieut. Engineers.

[We desire to call particular attention to the above letter, as since it was received by us, Lieut. Mahan has confirmed his good opinion of our Engines therein expressed, by ordering two more of them.]

CUYAHOGA WORKS



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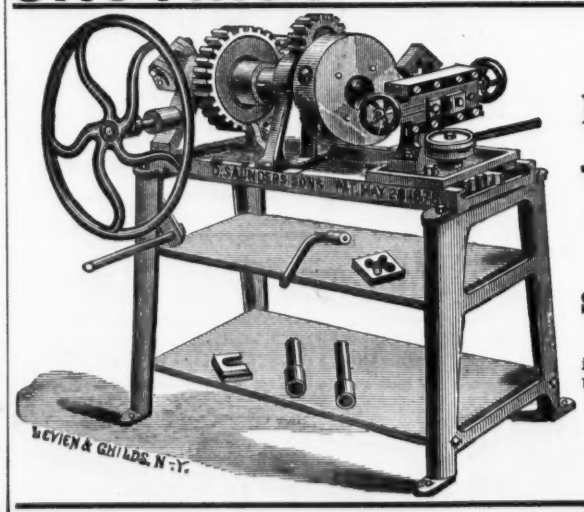

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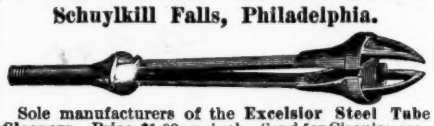

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All in good order, and will be sold very low.

One Engine Lathe, 23 in. swing x 21 ft. bed.
One " " 17 " " x 10 "
Two Engine Lathes, 16 " " x 7 "
Two " " 16 " " x 6 "
Three " " 16 " " x 5 "
Two Spinning Lathes.
One Speed Lathe.
One Plane, 24 in. x 24 in. x 7 ft.
One Plane, 36 in. x 36 in. x 9 ft.
One Engine Lathe, 28 in. swing x 14 ft. bed.
Seven Engine Lathes, 18 in. swing x 7½ ft. bed. (Chain-feed Lathes.)
One Horizontal Boring Lathe.
Two Wood-Turning Lathes.
One Bement Double-Pulley Lathe.
One Planer, 72 in. x 66 in. x 24 ft.
Two Planers, 22 in. x 5 ft.
One Four-Spindle Drill.
Three Bolt Cutters, various sizes.
One No. 2 Bolt Cutter.
One New "Hardaway" Bolt Heading Machine, to head up to ⅞-in. bolts.
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A lot of Wood Working Machinery.
Two Profiling Machines, two spindle.
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Six Small Punching Presses.
One N. Y. Safety Steam Power Co., upright.
25 H. P. Engine, and 20 H. P. Upright Boiler with all connections, &c.

New Tools Very Low.

Five No. 2 Bolt Cutters, Wood & Lighte.
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One 26 in. swing Upright Drill, not back geared.
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A WOODRUFF & BEACH BEAM ENGINE,

Low pressure, 42-in. cylinder, 84-in. stroke, with fly-wheel pulley, 20 ft. diameter, 36-in. face, and

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One 23 x 48 in. **Corliss Engine.**
One Engine Lathe, 90 in. x 20 ft. Ames. New.
One Engine Lathe, 72 in. x 20 ft.
One Engine Lathe, 37 in. x 24 ft. Pond. Good as new.
One Engine Lathe, 30 in. x 20 ft. Good order.
One Engine Lathe, 30 in. x 16 ft.. Wheeler, new.
One " " 26 in. x 14 ft. " "
One " " 26 in. x 13 ft., very heavy.
One " " 21 in. x 14 ft. Pond, good as new.
Five " " 20 in. x 10 ft. New. Lincoln.
One " " 16 in. x 8 ft. Wheeler.
One " " 16 in. x 8 ft. Star Tool Co.
One " " 15 in. x 6 ft.
One large Chucking Lathe and Chuck.
One Hand Lathe, 18 in. x 4½ ft.
Two " " 20 in. x 8 ft.
12 " " 11 in. x 4½ ft. New Spencer.
Six " " 7 in. x 2½ ft. " "
One Planer, 26 in. x 7 ft. Niles. New.
One " 22 in. x 5 ft. Wheeler. New.
One " 18 in. x 3 ft. "
One No. 3 Garvin Milling Machine.
One Garvin Cutter Grinder. New.
One Combined Cutter and Reamer Grinder, with Threading Tool Grinder attached. New.
Two 24 in. " " " Ames.
One 24 in. " " " P. & W. Self-feed.
One 20 in, " " " Prentiss, new.
One 10 in. " " " Blaisdell.
One Gear Cutter.
One each No. 0 P. & W. 2 Spindle Drills.
One each No. 1 P. & W. No. 3, 4 Spindle Drills.
Three Sensitive Drills, drills to 3-16 in. hole.
One No. 1 Wilder Punch Press. New.
One No. 3 " " " Geared. New.
One No. 4 " " " Geared. New.
One No. 6 " Shear. Geared.
One No. 1 Wilder Bar Iron Cutter. New.
One No. 3 " " " " "
One 10 H. P. Baxter Engine.
Seven Stephens' Vises.
Belting, Shafting and Miscellaneous Machinery.

We will also have ready to deliver in 30 days 24 Engine Lathes, 16 in. x 7 and 8 ft. beds. Ames Mfg. Co. make, *new*, A1 Lathes in every respect.

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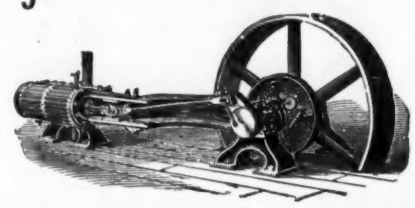
The Buckeye Automatic Cut-off Engine.



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BUCHANAN'S UNIVERSAL CRUSHER.

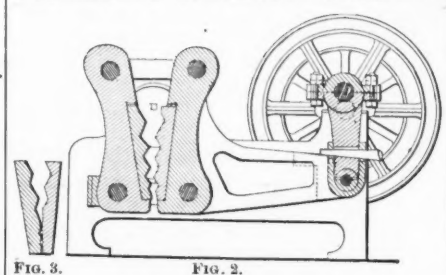

FIG. 3. FIG. 2.

Will crush from egg size down to dust. In sections. Double acting and durable. Its peculiar motion effects a great saving in power. For circulars and price list, address

C. C. BUCHANAN,
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Betts Machine Co.

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Have on hand a large lot of

NEW AND SECOND HAND
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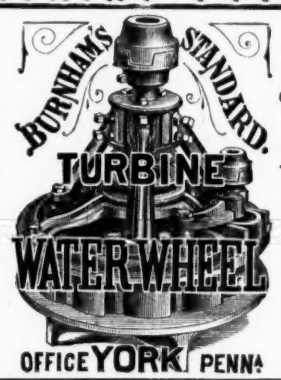

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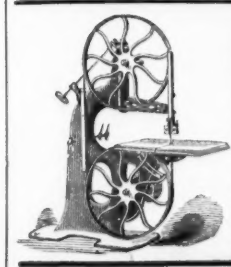

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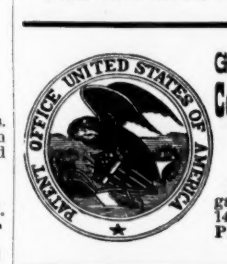

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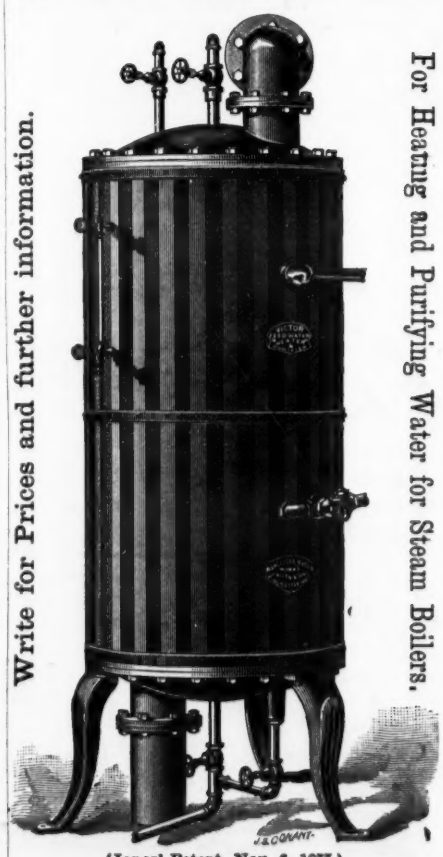

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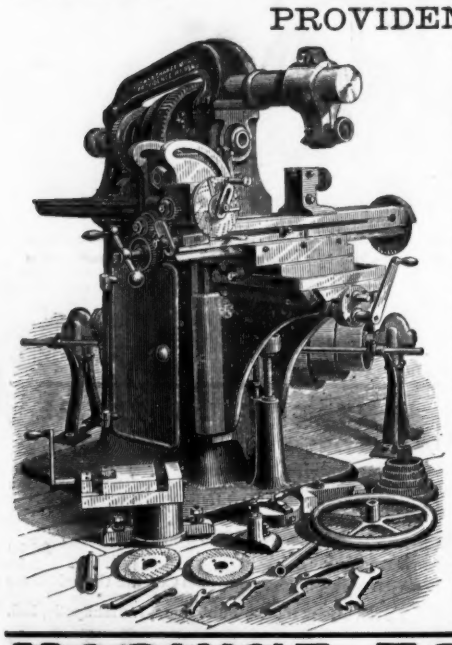

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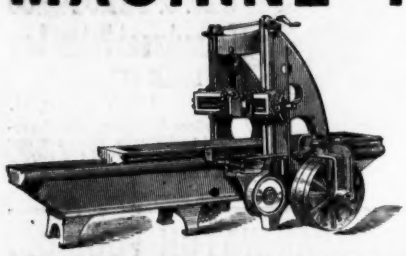

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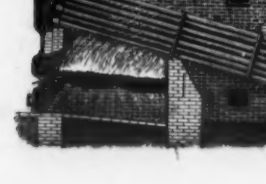

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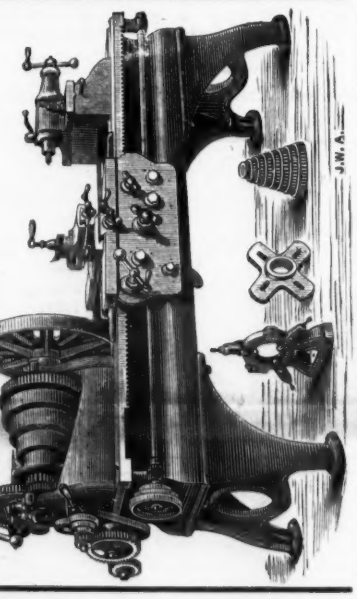

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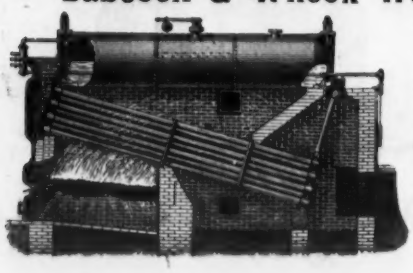

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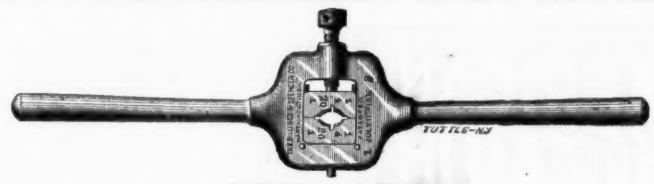

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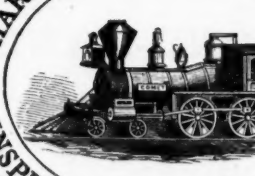

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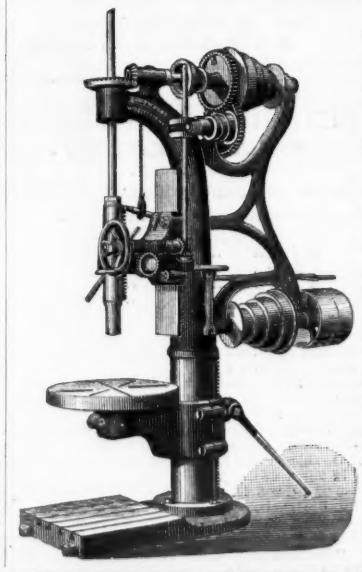

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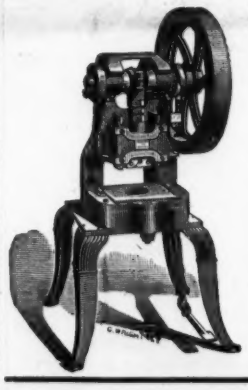

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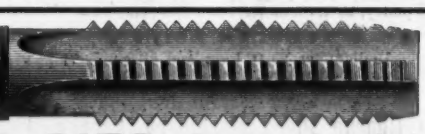

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